CREATIVITY, DEPRESSION, AND RUMINATION

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CREATIVITY, DEPRESSION, AND RUMINATION

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SUMMARY

Among creative professionals, affective vulnerability and diagnosed mood disorders are higher than would be expected in the general population (Ludwig, 1995). Rumination, that is, a broad class of thoughts that recur regardless of context or task and are centered around a common theme or idea (Martin & Tesser, 1996) may act as a third variable in the relationship between creativity and depression (Trani, submitted; Verhaeghen et al., 2014; Verhaeghen et al., 2005; Verhaeghen et al., 2017). Recently I proposed a model in which adaptive and maladaptive ruminations differentially influence creativity and mood (Trani, submitted). Essentially, rumination, maladaptive or otherwise, enhances associative processing by sustaining the activation of concepts within memory. Adaptive rumination supports creative associative processing by allowing concepts in memory to remain active despite being unrelated to present tasks or environments. In much the same way, maladaptive rumination works to sustain depressive symptoms across environments by sustaining activation of negative affect and related concepts in memory which would impair a person's ability to distract themselves from negative moods. I tested the hypothesized relationships between creativity, rumination, and depression using structural equation modeling. Roughly 450 participants completed an online battery of creativity, rumination, personality, and affective vulnerability measures. I present and discuss a model of rumination, creativity, and dysphoria.

CHAPTER 1
INTRODUCTION

Known as the ”mad-genius” hypothesis, there is a long-standing societal belief that people with mental illness or experiencing psychological suffering are more creative (for a review, see Becker, 2014). There is evidence supporting a relationship between depressive disorders and creativity (Akinola & Mendes, 2008; Hershman, 1998; Jamison, 1995; Kyaga et al., 2011; Post, 1996). Historiometric reviews reveal higher suicide rates and a higher rate of diagnosis for depressive disorders among eminent creative professionals when compared to population base rates and/or eminent professionals in other domains (Andreassen, 1987; C. Cox, 1926; Ellis, 1904; Goodwin & Jamison, 1990; Jamison, 1993; Kyaga et al., 2013; Ludwig, 1995, 1998; Post, 1994; Ramey & Weisberg, 2004; Simonton, 2014; Weisberg, 1994; Windsor-Shellard, 2017). In a review performed by Jamison (1993), depressive disorders among creative professionals were eight to ten times more likely than in the general population (Jamison, 1993). There are, however, a number of different psychological explanations for the connection.

One possible causal mechanism could be the alteration and disruption of cognitive processes that often occurs over the course of mood disorders (Gotlib & Joormann, 2010; Joormann & Gotlib, 2010; Simons et al., 1984; Weingartner et al., 1981). In some cases, these cognitive changes caused by psychopathology may support creative processing, up to a certain degree of psychopathological severity (Abraham, 2014b; Beaussart et al., 2014). For example, at mild levels, the euphoria and increased energy characteristic of hypomanic episodes may provide a boost to creative performance (American Psychiatric Association, 2013; Andreasen, 2008) and thus prove useful for creative professionals. As psychopathology becomes more severe, as often seen during manic episodes, cognitive processing is likely impaired beyond the ability to produce creative works and creative performance suf-

fers (Abraham, 2014a). This may explain why the siblings and children of people with bipolar are more creative than the general population (Kyaga et al., 2013; Kyaga et al., 2011; Simeonova et al., 2005).

The relationship between major depression and creativity, however, does not appear to take the shape of an inverted u-shaped curve. For example, even mild to moderate levels of depression negatively affect productivity (Rost et al., 2004), implying a negative linear relationship between dysphoria and creative production. Additionally, people are increasingly likely to engage in thought suppression as levels of dysphoria increases (Beevers et al., 1999). Creative abilities suffer as self-reported thought suppression increases (Verhaeghen et al., 2017).

Another, potentially more plausible mechanism driving the relationship between dysphoria and creativity is that a third variable may be at play – specifically, self-focused rumination (Verhaeghen et al., 2005; Verhaeghen et al., 2017). Rumination describes a class of thoughts consisting of chronic, passive, and persistent dwelling on an idea or topic occurring without direct environmental demand (Martin & Tesser, 1996; van Randenborgh et al., 2010). Self-focused rumination is a category of ruminative thought where the central idea or topic is the self (Verhaeghen et al., 2017).

The content of ruminative thoughts can be additionally categorized as adaptive or maladaptive. Adaptive ruminations increase psychological resilience (e.g., reduction in the frequency and severity of dysphoric mood) and may arguably improve cognitive processes like creativity (i.e., increasing the frequency and quality of creative ideas and activities). In contrast, maladaptive ruminations reduce psychological resilience and may impair cognitive processes – especially those related to problem solving and creativity.

The present study proposes a third-variable model to test the relationship between rumination, creativity, and mood disorder. Specifically, I seek answers for the following questions:

- Is there a direct, causal relationship between creativity and dysphoria?

- When acting as a third variable, do maladaptive ruminations and adaptive ruminations play differential roles in the relationship between creativity and dysphoria?

To answer these questions more precisely, we need to consider the nature of creativity, dysphoria, and rumination in more detail.

1.1 Creativity and Dysphoria

Creativity is commonly defined as the generation of ideas and solutions that are novel, useful, and of high quality (Amabile, 1983; Hennessey & Amabile, 2009; Runco, 2014; Sternberg, 2005). The stages involved in generating a creative idea or product are referred to as the creative process. Despite differing conceptualizations, almost all models of the creative process contain an initial preparation phase that leads to incubation and insight, followed by a verification stage and eventual implementation (Amabile, 1983, 2013; Basadur et al., 2012; Beaussart et al., 2014; da Costaa et al., 2015; Hogarth, 1980; Wallas, 1926). The creative process is briefly described below.

1.1.1 The Creative Process

Creativity, at its broadest, is a type of problem solving in response to the appearance of problems that cannot be solved in an immediately obvious way. When a person identifies a creative problem space, relevant knowledge retrieval and accumulation begins in an effort to both fully define the problem and identify potential solutions – a phase widely referred to as a preparation phase. While knowledge accumulates, periods of intense work and incubation (i.e., relative rest) are often interspersed. During incubation, associations still form between concepts related to the problem and concepts cued from a concurrent environment or task. Although some of these associations may be conscious, many of these associations occur outside of conscious awareness, leading to insight – that is, a feeling that a novel answer has been found from seemingly nowhere (Davidson & Sternberg, 1984). Because not all new ideas are necessarily good ideas, a verification stage tests the usefulness of all

new ideas and products as solutions to the original problem. If the verification stage proves successful, then the creative solution will be implemented and the creative process ends. If, however, the verification stage proves unsuccessful, then the creative process may be forced to either restart or end in failure – the determinant in this case is often motivation to continue.

1.1.2 Convergent and Divergent Thinking

Two cognitive processes identified as crucial for creative success are convergent and divergent thinking (Acar & Runco, 2012; Guilford, 1950, 1967, 1986; Kenett et al., 2014). These processes are differentially activated in response to specific types of problems. Divergent thinking, often elicited during open-ended problem solving (Abraham, 2014a), occurs when a gamut of appropriate ideas are generated around a single starting point (Batey & Furnham, 2008; Guilford, 1967). In contrast, convergent thinking occurs when thoughts synthesize to find a single correct answer to a problem (Arden et al., 2010; Claridge & McDonald, 2009; Guilford, 1950). Convergent thinking problems result in novel answers less frequently than divergent thinking problems (Dietrich & Kanso, 2010; Kaufman & Baer, 2005; Mumford et al., 1998; Mumford et al., 2008). Despite this, convergent thinking remains an important process – especially during the evaluation of the appropriateness of a novel solution (Jones et al., 2011; Lee & Therriault, 2013). Both divergent and convergent thinking are reliable indicators of individual creativity when used in combination (Baer, 2011; Dietrich, 2007; Dietrich & Kanso, 2010; Han, 2003; Runco, 1991, 2008; Ward et al., 1999).

Divergent thinking is thought to consist of four subfactors: fluency, flexibility, originality, and elaboration (Guilford, 1950; Runco, 2008; Torrance, 1965, 1969). Fluency is operationalized as the total number of creative responses a person can generate; it is believed to reflect the ease with which people produce new ideas. The more ideas a person generates, the greater the chances that ideas will be both novel and useful (Ansburg, 2000). Flexibility

is operationalized as the number of different categories of creative answers a person generates; it is thought to represent a person's ability to switch across different types of ideas. Generating a large number of responses across multiple cognitive categories increases the chances that a person will generate a creative response. Originality reflects how unique responses are. Elaboration reflects the amount and quality of additional details provided in each response. Assessment of the latter two aspects tends to involve the ratings of judges or experts (Amabile, 1983).

1.1.3 The Role of Depressive Disorders

Depressive disorders, the most common psychopathology in the United States (Substance Abuse & Mental Health Services Administration, 2017), exist in two distinct forms: major (unipolar) depression and bipolar depression. Roughly 7.1% of Americans will be diagnosed with major depression (National Institute of Mental Health, 2019) and 4.4% will be diagnosed with bipolar disorder (National Institute of Mental Health, 2017) at some point during their lives. Both major depression and bipolar disorder consist of episodes of persistently low affect, anhedonia, and other symptoms (e.g., disturbed sleep, feelings of guilt and inadequacy, and suicidal preoccupations) lasting for two-weeks or longer (Admon & Pizzagalli, 2015; American Psychiatric Association, 2013). Bipolar depression is distinguished from major depression by the presence of manic episodes – that is, periods of intensely elevated and expansive mood lasting for at least one week (American Psychiatric Association, 2013). Depressive episodes are more severe and longer in duration when left untreated (Melartin et al., 2004; Rosenberg & Kosslyn, 2014). In spite of this, many creative professionals avoid treatment for these disorders fearing reduced creative performance as a result of a more balanced mood (Jakovljević, 2013; Kyaga et al., 2011).

There are multiple reasons to doubt the hypothesis that depression results in improved creative performance. First, people are significantly less productive during a depressive episode when compared to their own productivity during healthy states or that of healthy

peers (Adler et al., 2006; Druss et al., 2001; Stewart et al., 2003). Second, positive affect is associated with improved creative performance when compared with negative or neutral mood states (Amabile et al., 2005; Fredrickson, 2009; Isen & Reeve, 2005). Third, associative processing is the foundation upon which creativity is built (Martindale, 1995), but, depression correlates with abnormal activity in the medial prefrontal cortex which can lead to over-inhibition of the medial temporal lobe, thus constraining activation of associative networks (Bar, 2009). Fourth, dysphoric and depressed people tend to have lower cognitive flexibility than controls (Ruiz & Odriozola-González, 2016) whereas highly creative people tend to be more cognitively flexible (Dreu et al., 2011). Fifth, problem-solving ability is negatively associated with psychopathology (Aldao et al., 2010).

In some cases, however, negative affect has been found to enhance creative processing (Akinola & Mendes, 2008; De Dreu et al., 2008; Kaufman & Baer, 2002). Negative affective states increase the number of solutions generated during creative tasks requiring divergent thinking, analogical problem solving, and precise attention to detail (Abele-Brehm, 1992; Akinola & Mendes, 2008; Jausovec, 1989; Kaufmann & Vosburg, 1997). One possible explanation is that negative affect may serve as a motivational signal that a project has not yet met one's creative standards, thus pushing one to work harder (De Dreu et al., 2008; George & Zhou, 2002; Martin et al., 1993). Additional evidence for this claim comes from the finding that people receiving negative social feedback tend to be more creative than people receiving nonsocial feedback or positive social feedback (Akinola & Mendes, 2008). Moreover, individuals with the greatest affective vulnerability benefit most from receiving negative social feedback (Akinola & Mendes, 2008).

1.2 Rumination as a third variable

The way people respond to their mood states changes the duration of these states and the frequency the mood will occur again in the future (Nolen-Hoeksema, 1991). Specific attempts to change the magnitude or the type of affective state a person experiences are

referred to broadly as emotional regulation strategies (Aldao et al., 2010). Rumination is a popular emotional regulation strategy hypothesized to manage emotions and cognitions associated with unexpected (i.e., faster or slower) rates of goal progression (Martin & Tesser, 1996). Specifically, rumination is a class of thoughts consisting of chronic, passive, and persistent dwelling on an idea or topic occurring in the absence of direct environmental demand (Martin & Tesser, 1996; van Randenborgh et al., 2010). People who focus passively on their current negative mood tend to be less psychologically resilient than people who engage in more active reflection with the intent of problem solving (Burwell & Shirk, 2007).

Negative affect may trigger introspective rumination (Costa et al., 2018) and detail-oriented thinking (Bodenhausen et al., 2000) allowing task-unrelated thoughts to influence cognitive processing without interference (Dijksterhuis & Meurs, 2006), increasing the chances of novel association formation (Trani, submitted). Habitual ruminators may be more willing to engage in the type of detail-oriented introspection necessary to produce meaningful creative works (Verhaeghen et al., 2014; Verhaeghen et al., 2005; Verhaeghen et al., 2017). At the same time, people who are more likley to ruminate are also more susceptible to the development of mood disorders (Nolen-Hoeksema et al., 2008).

Like most emotional regulation strategies, rumination can be classified as either adaptive or maladaptive (Aldao, 2013; Burwell & Shirk, 2007; Trapnell & Campbell, 1999). Ruminating about perceived failures, losses, mistakes, and unmet goals may leave a person especially vulnerable to the development of depressive episodes because it prevents people from engaging in more realistic goals that can increase feelings of competency (van Randenborgh et al., 2010). The content of adaptive self-focused ruminations tends to center around improving personal understanding of thoughts, feelings, and experiences (Trapnell & Campbell, 1999). In contrast, the content of maladaptive self-focused ruminations tends to center around perceived threats, losses, and injustices to the self (Trapnell & Campbell, 1999). Along with content, the impact ruminations have on affect and cognition can help

to determines the adaptiveness of ruminations (Burwell & Shirk, 2007; Ciesla & Roberts, 2007). Thus, rumination may begin as adaptive and, by the end of a period of rumination, shift to more maladaptive processing, or vice versa. Some evidence suggests that the intention to ruminate –that is, whether rumination is initiated deliberately or spontaneously – may influence the extent to which ruminations are adaptive. Spontaneous self-initiated ruminations often lead to more negative affect than more deliberate reflections (Ciesla & Roberts, 2007; Trapnell & Campbell, 1999; Treynor et al., 2003). I will explore the nature of maladaptive and adaptive ruminations in detail in the following sections.

1.2.1 Maladaptive Rumination

Maladaptive ruminations decrease positive affect and/or psychological resiliency, are not likely to help problem solving, and are often reported as unwanted by the people experiencing them (McIntosh & Martin, 1992; Nolen-Hoeksema et al., 2008; Pyszczynski & Greenberg, 1987). Maladaptive ruminations are strongly and positively correlated with neuroticism and depression (Trapnell & Campbell, 1999). Historically, rumination has been studied in relation to mood disorders, emphasizing rumination in response to dysphoric mood states (Chen & Li, 2013; Johnson et al., 2014; Nolen-Hoeksema & Morrow, 1991; Nolen-Hoeksema et al., 2008). Because of this, the majority of rumination research has focused on maladaptive ruminations, specifically, depressive rumination.

Depressive rumination, a form of maladaptive rumination, is a chronic and passive fixation on the symptoms, causes, and consequences of depressive states and negative affect (Nolen-Hoeksema, 1987, 1991, 2000a; Nolen-Hoeksema et al., 1993). Engaging in depressive rumination reduces psychological resiliency by increasing the duration and intensity of negative moods (Abela et al., 2004; Burwell & Shirk, 2007; Ciesla & Roberts, 2007; S. Cox et al., 2012; Hilt et al., 2012; Jose & Brown, 2008; Nolen-Hoeksema, 1987, 1991; Nolen-Hoeksema et al., 1993; Nolen-Hoeksema & Watkins, 2011; Spasojevic & Alloy, 2002). Depressive rumination is more strongly related to depressive symptoms than gen-

eral forms of self-focused attention are (Mor & Winquist, 2002). Even when controlling for initial levels of depressive symptoms (Lyubomirsky & Tkach, 2003; Nolen-Hoeksema et al., 2008), depressive ruminators have longer and more severe depressive episodes than their non-ruminating peers (Ciesla & Roberts, 2007; W. Hong et al., 2010; Just & Alloy, 1997; Kuehner & Weber, 1999; Nolan-Hoeksema et al., 1998; Nolen-Hoeksema, 2000b; Nolen-Hoeksema & Morrow, 1991; Nolen-Hoeksema et al., 1993; Nolen-Hoeksema et al., 1994; Schmaling et al., 2002; Spasojević & Alloy, 2001). Brooding is a typical example of a maladaptive rumination strategy. It consists of passive comparisons of a person's current situation with an unachieved - and often, unachievable - standard (Treynor et al., 2003). Brooding responses, commonly observed during depressive rumination, reflect a maladaptive type of moody pondering highly indicative of depressive cognitions (Joormann & Gotlib, 2010; Lo et al., 2008; Matthews & Wells, 2014; Pearson et al., 2010). People higher in brooding are more likely to engage in other behaviors that reduce psychological resilience including avoidance, suppression, denial, and substance abuse (Aldao et al., 2010; Burwell & Shirk, 2007).

Why do people engage in maladaptive rumination in the first place? People are more likely to spend time ruminating if they hold positive beliefs about rumination (Watkins & Moulds, 2005). Ruminators describe maladaptive rumination as dangerous and uncontrollable (Papageorgiou & Wells, 1999). Yet, roughly 80% of people who frequently engage in maladaptive rumination report at least one perceived benefit from this behavior (Watkins & Baracaia, 2001), namely that it provides insight into both depression and life problems (Lyubomirsky & Nolen-Hoeksema, 1993; Papageorgiou & Wells, 1999) This seems to be particularly the case for people with a history of depression (Papageorgiou & Wells, 2001; Watkins & Moulds, 2005).

In line with these beliefs, it seems that maladaptive ruminations effectively reduce depressive symptoms at first. This is likely because engaging in self-focused rumination may prolong an affective state and its associated cognitions long enough for people to gain in-

sight and understanding – or at least, to feel they do (Papageorgiou & Wells, 2003). People who respond to negative affect with adaptive rumination (e.g., reflection) may experience an immediate worsening of depressive symptoms compared to maladaptive ruminators, but as time progresses, maladaptive rumination – not adaptive rumination – is positively associated with depressive symptoms (Treynor et al., 2003).

1.2.2 Adaptive Rumination

Adaptive ruminations are strongly and positively associated with intelligence and openness to experience (Trapnell & Campbell, 1999). Importantly, creativity is also strongly and positively associated with intelligence and openness to experience (Silvia, 2008). Adaptive rumination may help people identify specific problem-solving goals (Burwell & Shirk, 2007) which may sustain motivation during the creative process. Additionally, people higher in adaptive rumination may be more willing to engage in active problem-solving efforts (Burwell & Shirk, 2007).

Reflective rumination is one often-studied example of adaptive rumination. It consists of an active attempt to explore, understand, and cope with personal thoughts, emotions, and experiences (Arditte & Joormann, 2011; Joormann & Gotlib, 2010; Nolen-Hoeksema et al., 2008; Trapnell & Campbell, 1999; Treynor et al., 2003). Reflective rumination does not carry the same risks for developing psychopathology as other forms of rumination (Trapnell & Campbell, 1999). Longitudinal studies have shown that people higher in reflection at initial assessment measured lower in dysphoria (Treynor et al., 2003) and were more likely to have recovered from previously diagnosed depression at follow up (Arditte & Joormann, 2011). Because reflection indicates awareness of the interaction between adaptive coping strategies and emotional experiences, reflection may also be an indicator of emotional intelligence (Burwell & Shirk, 2007).

1.2.3 Rumination and Depression

When compared to healthy controls who rely primarily on reflection as an emotion-regulation strategy, people diagnosed with major depressive disorder are more likely to turn to brooding, a maladaptive form of rumination (Joormann et al., 2006). Brooding consists of passive comparisons of a person's current situation with an unachieved and often unacheivable standard (Treynor et al., 2003). High stress reactivity is linked to depression and low resilience to stress (see Southwick et al., 2005, for a review) as well as rumination (Disner et al., 2011). People with a lower sense of mastery over important life events as well as those who experience more chronic stress and challenges are more likely to ruminate (Nolen-Hoeksema, 1996). One reason for this is that people with a lower sense of mastery may feel like they have little control over the things that happen to them and that there is little they can individually do to control problems once they've started (Nolen-Hoeksema et al., 1999). Brooding significantly moderates the relationship between stress and depression (S. Cox et al., 2012). Interview-rated assessments of depression as well as maternal- and self-ratings of depression symptoms both concurrently and longitudinally are associated with brooding in adolescents (Burwell & Shirk, 2007). This may be in part because a higher tendency to engage in depressive brooding is associated with a lower sense of mastery and greater feelings of chronic stress and strain (Disner et al., 2011; Treynor et al., 2003), and high stress reactivity is in itself linked to depression and low resilience to stress (see Southwick et al., 2005, for a review).

The link between reflection, a more adaptive rumination strategy, and depression is less clear. For instance, once brooding is accounted for, reflection is unrelated to concurrent self-reported depression symptoms and changes in self-reported depression symptoms over time as well as longitudinal and concurrent maternal-reports of depression symptoms (Burwell & Shirk, 2007). Additionally, reflection is only moderately related to interview-rated concurrent depression symptoms (Burwell & Shirk, 2007). The reason may be that brooding is associated with negative attentional biases while reflection is not (Joormann

et al., 2006).

Neurological correlates further support an association between rumination and depression. Both rumination (Kross et al., 2009) and major depressive disorder (Berman et al., 2011; Greicius et al., 2007; Mayberg et al., 2005) are associated with increased activity and connectivity within the subgenual cingulate cortex. Important to the present study, changes in this region associated with rumination stem from maladaptive ruminations rather than adaptive ruminations (Berman et al., 2011).

1.2.4 Rumination and Creativity

Rumination is not a form of problem solving in that it lacks efforts to change either the contingencies or the consequences of a situation (Aldao et al., 2010; Burwell & Shirk, 2007; Nolen-Hoeksema, 1991). Despite this, ruminations centered around a goal may support problem solving by sustaining activation of goal-related concepts in memory (Verhaeghen et al., 2005).

Rumination may also support creative processing by prolonging an affective experience. Creativity is supported by both positive (Isen, 2000) and negative affect (Akinola & Mendes, 2008). The number of solutions generated for creative tasks that require concentration, divergent thinking, analogical problem solving and precise execution are higher for participants in negative rather than positive mood states (Akinola & Mendes, 2008). During negative mood states, rumination may enhance critical evaluations, introspection, and careful deliberation of creative work increasing quality (Akinola & Mendes, 2008). The nature of rumination might come into play here as well. Assuming that rumination enhances associative processing (Trani, submitted), adaptive rumination should provide neutral distraction that may simultaneously increase creativity and – through distraction – reduce dysphoria.

It is, however, very unlikely that maladaptive rumination per se would support creativity. Maladaptive ruminators are more indecisive, less likely to engage in active problem

solving after ruminating, and demonstrate reduced problem solving ability when compared to adaptive ruminators and healthy peers (Aldao et al., 2010; Burwell & Shirk, 2007; Carver et al., 1989; Folkman & Lazarus, 1980, 1986; R. Y. Hong, 2007). Maladaptive ruminators struggle to disengage with contexts and goals that are no longer relevant or rewarding (Whitmer & Gotlib, 2013), possibly stemming from reduced cognitive flexibility (Cohen & Ferrari, 2010; Davis & Nolen-Hoeksema, 2000; Lyubomirsky et al., 1999). Failing to meet a goal increases negative affect which may trigger maladaptive rumination in ruminators, prolonging efforts on potentially unachievable goals (van Randenborgh et al., 2010). In sum, maladaptive ruminators may be less willing to engage when faced with creative problems and struggle to disengage from efforts that are unachievable, thus reducing productivity.

1.3 Resulting Hypotheses

To test my proposed theory that adaptive and maladaptive rumination differentially impact the relationship between creativity and dysphoria, I proposed the following hypotheses:

- H1: Rumination is a complex construct representing both maladaptive and adaptive behaviors and cognitions.
- H2: People higher in adaptive rumination will measure higher in creativity and lower in dysphoria.
- H3: People higher in maladaptive rumination will measure higher in dysphoria and lower in creativity.

In the next section, I detail how I will test these hypotheses.

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CHAPTER 2

METHODS

2.1 Population

Data was collected from 250 Amazon Mechanical Turk (AMT) workers and 216 students at the Georgia Institute of Technology. Students were recruited using the virtual participant pool website, SONA. After signing up, students and AMT workers were provided a link to access the study. Students received 2 hours of participation credit. Workers were compensated $10 for submitting a survey response. To be eligible for the study, participants were required to be fluent in English and over the age of 18. AMT workers were additionally required to have a 97% HIT approval rate. Of the total participants who submitted data, 10 participants (2 students, 8 AMT workers) were eliminated for inappropriate responding. Thus, the total number of participants included in analyses was 456. Because I did not have existing hypotheses regarding gender or age, demographic data were not collected.

2.2 Measures

The present study investigates trait rumination, creativity, and dysphoria. The measures used to define these constructs are described in the following subsections. Please refer to Appendix A for full measures.

2.2.1 Trait Rumination

When ruminative responses become chronic or habitual, people are classified as trait ruminators. Trait rumination measures assume that people who more frequently engage in previous ruminative behaviors are more likely to engage in future ruminations. Therefore, measures of trait rumination assess the likelihood that a person will respond with rumi-

native behaviors to future problems. All assumptions about the adaptiveness of the types of rumination measured by each of the subscales were tested using confirmatory factor analysis.

Broad Rumination Scale

The Broad Rumination Scale (**BRS**; Trani & Verhaeghen, forthcoming) assesses rumination along a range of eight proposed components: brooding, compulsivity, distractibility, optimism, personal expressiveness, reflectiveness, social expressiveness, and worrying. Participants are presented with 34 statements and asked to indicate the extent to which they agree that each statement describes their thoughts and behaviors using a 7-point Likert-type scale (1-strongly disagree; 7-strongly agree). Responses on items for each subfactor are summed to provide a total subfactor score.

Brooding represents a person's tendency to engage in passive, negative cognitions about the self. Higher scores indicate greater brooding. Questions assessing brooding include: "Bad things always seem to happen to me", and "When something goes wrong, I tend to think of all the things that have recently gone wrong".

Compulsivity assesses the degree a person is able to disengage from intrusive thoughts and events. Higher scores indicate greater preoccupation with intrusive thoughts and events. Questions assessing compulsivity include: "When I start to worry, it is very hard for me to stop", and "It is very difficult for me to calm down when I am upset".

Distractibility assesses the degree a person can maintain focus on a task without intrusive thoughts or having attention captured from task-unrelated stimuli – a higher score indicates a person more prone to distraction. Questions assessing distractibility include: "When I am emotional, it is hard for me to focus on what I am supposed to be doing", and "I find myself daydreaming when I should be paying attention".

Optimism assess the tendency to engage in passive, positive cognitions about the self. Higher scores indicate greater positivity. Questions assessing optimism include: "My

thoughts about myself are more often positive than negative", and "I am capable of overcoming life's obstacles".

Personal expressiveness assesses the extent to which a person engages in hobbies to express ruminative thoughts. Higher scores indicate a greater tendency toward personal expression of ruminative thoughts. Questions assessing personal expressiveness include: "My creative hobbies are a way for me to communicate how I am feeling", and "I use my hobbies as a way of expressing myself".

Reflectiveness assess a person's tendency to passively analyze their thoughts and feelings with the goal of greater understanding – higher scores indicate greater reflection. Questions assessing reflectiveness include: "It is important for me to understand why I am feeling a certain way", and "I like to analyze my thoughts".

Social expressiveness assesses the extent that a person engages in social conversation to express ruminative thoughts with higher scores indicating a greater tendency toward social rumination. Questions assessing social expressiveness include: "I tend to vent to my friends when I am feeling overwhelmed", and "It helps me to talk about my problems with other people".

Worrying assesses a person's tendency to ruminate about the future. Questions assessing worrying include: "Last minute changes in plans are frustrating for me", and "Uncertainty about the future bothers me".

Ruminative Responses Scale

The Ruminative Responses Scale (**RRS**; Nolen-Hoeksema & Morrow, 1991) is a measure of rumination in response to dysphoria. Participants are presented with a 22-item list of common behaviors that people engage in while feeling sad or depressed. For each item, participants indicate on a 4-point Likert-type scale how frequently they engage in each behavior from *1-almost never* to *4-almost always*. Questions can be split into three subfactors: depression related symptoms, brooding, and reflection (Treynor et al., 2003).

Brooding is hypothesized to be a maladaptive process where a person passively focuses on the symptoms of low affect. Questions assessing brooding include: ”Think ’What am I doing to deserve this?’”, ”Think ’Why do I have problems other people don’t have?’”, ”Think ’Why can’t I handle things better?’”. In contrast, reflection is hypothesized to be an adaptive process representing a person’s willingness to evaluate private thoughts and feelings. Questions assessing reflection include: ”Analyze recent events to try to understand why you are depressed”, ”Write down what you are thinking and analyze it”, ”Analyze your personality to try to understand why you are depressed”. Scores for each subfactor are obtained by summing the total value of the relevant responses. Depression related items were excluded due to their confounding relationship with dysphoria (Treynor et al., 2003).

Responses to Positive Affect Scale

The Responses to Positive Affect Questionnaire (**RPA**; Feldman et al., 2008) assesses the extent to which people engage in ruminative processing while experiencing a positive mood state. Participants are presented with 17 statements and the following instructions: ”People think and do many different things when they feel happy. Please read each of the following items and indicate whether you never, sometimes, often, or always think or do each one when you feel happy, excited, or enthused. Please indicate what you generally do, not what you think you should do”. Participants responded using a 4-point Likert-type scale (1-almost never; 4-almost always).

Items can be separated into three distinguishable factors: emotion-focus, self-focus, and dampening. Emotion-focus items measure a person’s tendency to ruminatively fixate on the experience of positive affect while in a positive mood state. Examples of emotion-focus items include: ”think about how happy you feel”, ”think about how strong you feel”, ”notice how you feel full of energy”. Self-focus items measure a person’s tendency to ruminatively fixate on the self while in a positive mood state. Examples of self-focus items include: ”think about how proud you are of yourself”, ”think ’I am achieving everything’”,

”think ’I am getting everything done’”. Dampening items measure a person’s tendency to try and reduce feelings of positive affect while in a positive mood state. Dampening items include: ”think about things that could go wrong”, ”remind yourself these feelings won’t last”, ”think ’this is too good to be true’”. A total score is obtained by summing the relevant item responses for each factor so that higher scores indicate greater expression of factor-related behaviors.

2.2.2 Creativity

Creativity in the present study is a composite construct consisting of the common variance between divergent thinking, convergent thinking, creative self-beliefs, and real-world creative achievement.

Divergent Thinking

The Torrance Test of Creative Thinking - Verbal (**TTCT-V**; Torrance, 1965) is a measure of divergent thinking. Participants see a standard image and are asked: ”Just suppose you could walk on air or fly without being in an airplane or similar vehicle. What problems might this create?”.

The Purdue Creativity Test (PCT; Lawshe & Harris, 1960) is a measure of divergent thinking. Each item asks participants to imagine all the possible uses for a figural line drawing. The present study presents people with 3 different figural line drawings, – that is, three different Purdue test items.

Participants have three minutes to answer each of the four divergent thinking tests. The total number of valid responses are counted to form a total fluency score across the four test items.

Convergent Thinking

The Remote Associates Test (RAT; Mednick, 1968) assesses convergent thinking by presenting participants with three seemingly unrelated words. Participants are asked to find a fourth word which would connect all the words together. For example, participants may see the words ”duck”, ”fold”, and ”dollar”. These words can be connected with a fourth word: ”bill”. The present study uses a 30-item list chosen from the Bowden and Jung-Beeman (2003) normed set of stimuli. There are 10 items in each difficulty set; easy, medium, and hard. Items are presented in order from easiest to hardest with an ample five-minute time limit.

Creative Achievement

The Creative Achievement Questionnaire (CAQ; Carson et al., 2005) assesses real world creative achievement across ten creative domains: Visual arts, music, dance, architectural design, creative writing, humor, inventions, scientific inquiry, theater and film, and the culinary arts. For each of the ten domains, participants mark the statements that describe their creative achievements. Additionally, participants indicate the number of times they have received rewards or national recognition for accomplishments in each domain. Points across each domain are combined for an overall creativity score.

Creative Personality

The Short Scale of Creative Self (SSCS; Karwowski et al., 2018) is composed of 11 personally descriptive statements measuring creative self-concept. Participants are asked to rate the extent to which each statement accurately describes their beliefs about creativity using a Likert-type scale ranging from 1-definitely not to 5-definitely yes. Example items include: ”My creativity is important for who I am” and ”I trust my creative abilities”. Item scores are summed to yield a total score.

2.2.3 Dysphoria

Dysphoria was measured using the Center for Epidemiological Studies Depression Scale Revised (CESDR; Eaton et al., 2004). The CESDR consists of twenty items measuring depression symptoms including anhedonia, sadness, feelings of worthlessness, and suicidal ideation. Responses are scored on a 5-point Likert-type scale where participants indicate the frequency with which they have experienced a described symptom over the past two weeks from not at all (0 days a week) to nearly every day for 2 weeks. Answers are summed to form a single score. Example questions include: ”I felt sad”, ”I lost interest in my usual activities”, and ”Nothing made me happy”.

CHAPTER 3

RESULTS

Data were cleaned and analyzed using Python version 3.8 and R-studio for Windows 10. Structural equation models (SEM)s were analyzed using EQS 6.4 for Windows 10 (Bentler, 2006). Code and datasets will be posted to a github repo upon successful completion of this dissertation.

3.1 Descriptive Statistics

Because measures were administered to two, potentially different populations, it was necessary to check for differences in Cronbach's alphas between groups. Group Cronbach's alphas are reported in Table 3.1 – the two populations are adequately similar.

Table 3.1. Group Alphas Among Tested Variables.

Measure	Amazon	Georgia Tech	Full Sample
Remote Associates Test	0.90	0.80	0.89
Divergent Thinking	0.85	0.85	0.85
Creative Achievement Questionnaire	Unable to compute alpha		
Short Scale of Creative Self	0.95	0.88	0.93
BRS Brooding	0.87	0.69	0.81
BRS Compulsivity	0.88	0.73	0.82
BRS Distractibility	0.86	0.78	0.85
BRS Optimism	0.88	0.76	0.84
BRS Personal Exp.	0.83	0.77	0.80
BRS Reflection	0.77	0.74	0.76
BRS Social Exp.	0.81	0.79	0.80
BRS Worrying	0.67	0.44	0.57
RPA Emotion-Focus	0.83	0.79	0.81
RPA Dampening	0.87	0.84	0.85
RPA Self-Focus	0.86	0.77	0.82
RRS Brooding	0.89	0.79	0.83
RRS Reflection	0.77	0.74	0.76
Dysphoria	0.96	0.93	0.95

Note. Divergent Thinking = Purdue and Torrance tests. BRS = Broad Rumination Scale. RPA = Responses to Positive Affect Scale. RRS = Ruminative Responses Scale. Dysphoria = Center for Epidemiological Studies Depression Scale Revised. (n = 456)

Table 3.1: Group Cronbach's Alphas

Consequently, all descriptive statistics and all subsequent analyses were run on the combined dataset. Means, standard deviations, and Pearson correlations for all tested variables are reported in Table 3.2. Of interest for further data analysis, the RRS-reflection and RRS-brooding subscales are correlated at r= .53, p¡0.01. This correlation is surprisingly high for two scales posited to represent opposing factors – that is, a maladaptive and an adaptive factor that represent different underlying cognitive thought processes – so it is very likely that, when compared to other measures, the RRS is primarily capturing maladaptive rumination.

3.2 Rumination Measurement Model

As an additional check to ensure that the rumination scales were behaving as expected, I tested each scale using robust confirmatory factor analysis in EQS version 6.4 on Windows 10. Expected scale structure was confirmed for each subscale. Interested readers are directed to Appendix C for detailed results from these analyses.

Please note that I have standardized the presentation of structural equation models. Observed variables are represented as rectangular boxes while latent variables are represented as ovals. Causal relationships are indicated as directional arrows with independent variables pointing to dependent variables. Correlational relationships are indicated as curved, bi-directional arrows. Statistically non-significant relationships are indicated in red. Any paths constrained to one (to anchor the latent factor to its presumed most representative measurement) are indicated as dashed lines. Please note that for each independent variable, at least one path must be set to one for model functionality. The beta-weight for this path is still calculated in the overall model. Finally, path and error values are not reported for models other than the final models.

Model fit for structural equation models and confirmatory factor analyses were determined based on the criteria set forth in Byrne (2008). The chi square statistic remains one of the most commonly reported indicators of fit in SEM as it tests the extent to which data

Table 3.2. Pearson Correlations, Means, and Standard Deviations Among Tested Variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	M	SD
1. RAT	----																					10.71	6.64
2. BRS-B	-0.17**	----																				20.05	6.72
3. BRS-C	-0.04	0.68**	----																			20.62	7.08
4. BRS-D	-0.17**	0.57**	0.71**	----																		20.76	6.94
5. BRS-O	-0.03	-0.55**	-0.55**	-0.5**	----																	25.55	5.97
6. BRS-PE	-0.01	0.02	0.04	0.04	0.21**	----																14.71	4.27
7. BRS-R	-0.08	0.08	0.09	0.07	0.22**	0.33**	----															22.24	3.87
8. BRS-SE	-0.0	-0.14**	-0.09	-0.06	0.32**	0.26**	0.34**	----														16.59	5.59
9. BRS-W	-0.09	0.6**	0.61**	0.5**	-0.34**	0.09	0.16**	-0.02	----													15.34	3.66
10. RPA-E	-0.12*	-0.13**	-0.08	-0.06	0.42**	0.31**	0.3**	0.33**	-0.05	----												13.46	3.29
11. RPA-D	-0.2**	0.67**	0.48**	0.45**	-0.39**	0.04	0.03	-0.16**	0.44**	-0.12**	----											15.98	5.01
12. RPA-S	-0.11*	-0.24**	-0.21**	-0.23**	0.56**	0.33**	0.22**	0.3**	-0.12*	0.72**	-0.18**	----										9.40	2.91
13. RRS-B	-0.18**	0.64**	0.61**	0.54**	-0.4**	0.13**	0.16**	-0.04	0.5**	0.11*	0.59**	-0.01	----									8.99	3.36
14. RRS-R	-0.1*	0.35**	0.32**	0.27**	-0.11*	0.31**	0.49**	0.05	0.27**	0.29**	0.34**	0.1*	0.53**	----								12.25	3.43
15. CESDR	-0.13**	0.61**	0.53**	0.52**	-0.53**	0.04	0.02	-0.2**	0.34**	-0.1*	0.56**	-0.25**	0.55**	0.38**	----							16.00	15.48
16. CAQ	-0.1*	0.07	-0.02	-0.02	0.07	0.21**	0.13**	0.09	0.03	0.15**	0.12*	0.09*	0.08	0.2**	0.15**	----						9.71	14.18
17. Purdue1	0.19**	-0.05	0.08	0.13**	-0.06	0.07	0.18**	0.01	0.1*	0.01	-0.1*	-0.09	-0.0	0.12*	0.08	0.04	----					7.12	3.50
18. Purdue2	0.26**	-0.05	0.1*	0.11*	-0.09	0.06	0.17**	-0.01	0.05	0.01	-0.09*	-0.1*	0.01	0.17**	0.07	0.0	0.71**	----				5.94	2.91
19. Purdue3	0.23**	-0.06	0.06	0.06	-0.11*	0.06	0.15**	0.01	0.01	-0.02	-0.1*	-0.08	-0.0	0.12**	0.05	-0.0	0.64**	0.69**	----			4.39	2.42
20. Torrance	0.26**	-0.09	0.02	0.05	-0.06	0.06	0.07	0.02	0.01	0.02	-0.15**	-0.05	-0.06	0.05	-0.0	-0.0	0.55**	0.55**	0.5**	----		5.70	3.08
21. SSCS	-0.02	-0.18**	-0.13**	-0.13**	0.35**	0.55**	0.29**	0.21**	-0.08	0.27**	-0.09	0.31**	-0.06	0.13**	-0.06	0.25**	0.12**	0.11*	0.13**	0.06	----	2.75	0.84

Note. RAT = Remote associates test. BRS = Broad Rumination Scale: BRS-B = Brooding subscale; BRS-C = Compulsivity subscale, BRS-D = Distractibility subscale; BRS-O = Optimism subscale; BRS-PE = Personal Expressiveness subscale; BRS-R = Reflection subscale; BRS-SE = Social Expressiveness subscale; BRS-W = Worrying subscale. RPA = Responses to Positive Affect Scale: RPA-E = Emotion-Focused subscale; RPA-S = Self-focused subscale; RPA-D = Dampening subscale. RRS = Ruminative Responses Scale: RRS-B = Brooding subscale; RRS-R = Reflection subscale. CESDR = Center for Epidemiological Studies Depression Scale Revised. CAQ = Creative Achievement Questionnaire. SSCS = Short Scale of Creative Self. (*n = 456*)

** = significant at the p < 0.05 level. ** = significant at the p > 0.01 level.*

Table 3.2: Means, standard deviations, and Pearson correlations

from a predicted model and observed data are equal. Ideally, the null hypothesis should not be rejected as predicted models should match observed data. In the present dissertation, the Satorra-Bentler scaled statistic was used as the chi square statistic which is corrected for non-normality commonly present in large samples (Byrne, 2008). Generally speaking, researchers tend to divide the total chi square statistic by the degrees of freedom with values less than 5 indicating acceptable fit.

Because the chi square statistic is one of the least reliable indicators of fit in large samples, additional indicators of fit are provided and used to evaluate fit. The comparative fit index (CFI) ranges in value from 0.00 to 1.00 and compares the hypothesized model to the independence model – that is, the model fit that would be obtained if all variables in the model were mutually uncorrelated. As a benchmark, CFI values above 0.90 are acceptable (Schumacker & Lomax, 2004) with values higher than 0.95 indicating ideal fit (Hu & Bentler, 1999).

Akaike's Information Criterion (AIC) and the consistent version of the AIC (CAIC) are also reported. These fit statistics take into account the parsimony of the model – that is, these estimates take into account the number of estimated parameters in the calculation of goodness of fit. In accounting for parsimony, these metrics can indicate how well models will cross validate in future samples (Byrne, 2008). As an added benefit, these indices can be used to test model fit between two different and non-nested models. Although an ideal benchmark for these measures has not been established, smaller values indicate a better fitting model.

Perhaps the most informative criterion in covariance model fit testing, the root mean square error of approximation (RMSEA) indicates the extent that the proposed model, with optimally chosen parameter values, would fit the population covariance matrix if it were available (Byrne, 2008). As a benchmark, values less than 0.10 are considered acceptable model fit with ideal model fit obtained at values less than 0.08. RMSEA has the added benefit of providing statisticians with a confidence interval – that is, it allows us to estimate

with 90% confidence that the true RMSEA value in the population will fall within the provided confidence interval bounds. Generally, tighter confidence interval bounds are seen as further indication of model fit and precision (Byrne, 2008).

For the present study, I did not combine all subscales from all scales purported to measure rumination into a single score, as is often done. Instead, I grouped subscales based on their assumed adaptiveness and tested the veracity of this model using confirmatory factor analysis. Those subscales that were not clearly adaptive or maladaptive in nature were allowed to crossload on both adaptive and maladaptive rumination factors. See Table 3.3 for information about how subscales were assigned to rumination adaptivity factors.

Table 3.3 Rumination Subscales and Ruminative Adaptivity Factors

Measure	Subscale	Adaptivity Factor
BRS	Brooding	Maladaptive
	Compulsivity	Cross-Loading
	Distractibility	Cross-Loading
	Optimism	Adaptive
	Personal Exp.	Cross-Loading
	Reflectiveness	Adaptive
	Social Exp.	Cross-Loading
	Worrying	Maladaptive
RRS	Brooding	Maladaptive
	Reflection	Adaptive
RPA	Dampening	Maladaptive
	Emotion-Focus	Cross-Loading
	Self-Focus	Adaptive

Note. BRS = Broad Rumination Scale.
RPA = Responses to Positive Affect Scale.
RRS = Ruminative Responses Scale.

Table 3.3: Subscale assignment to rumination adaptivitiy factors

In this measurement model, the adaptive and maladaptive rumination factors were allowed to correlate. Model fit statistics for the initially proposed structure were less than ideal – that is, chi square was significant, RMSEA was above 0.10, and CFI was below 0.90. Additionally, several relationships were statistically non-significant (see Figure Figure 3.1 for more detailed information).

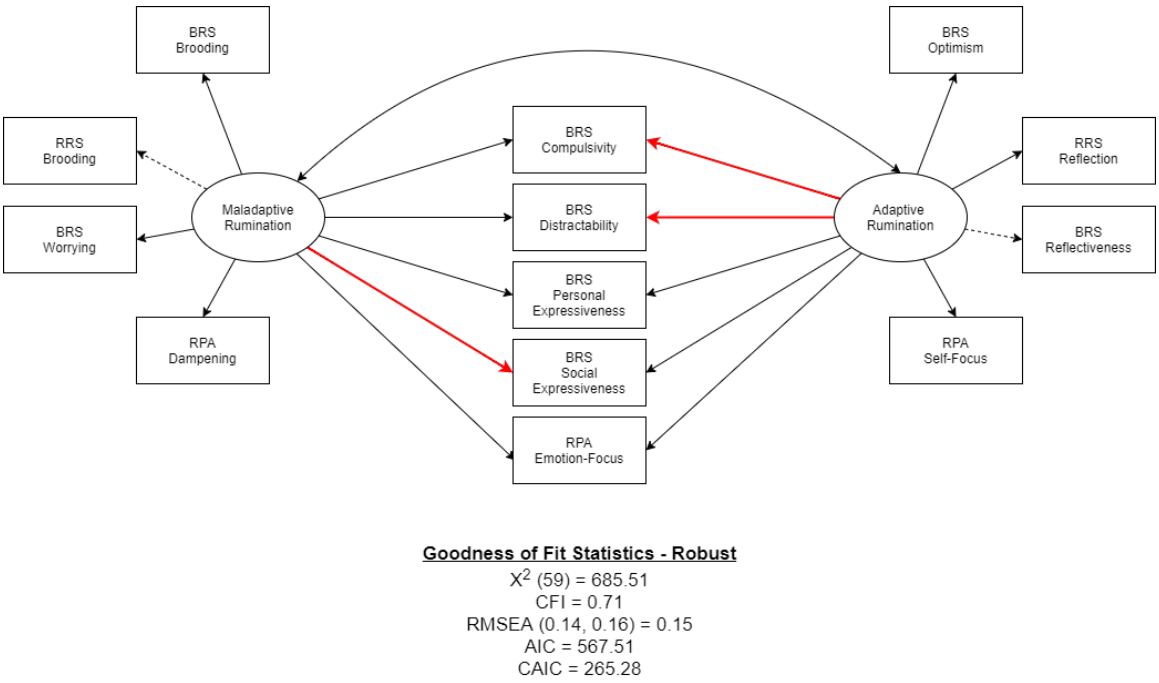


Figure 3.1: Measurement model of initially proposed rumination adaptivity factors.

The Legrange Multiplier test for adding parameters suggested an improvement of fit if the BRS-optimism and RRS-reflection subscales were allowed to crossload on both adaptive and maladaptive factors. Employing these suggestions and removing non-significant paths did improve model fit from the initial model – that is, chi square gained a degree of freedom and decreased by 253.74 points, CFI increased from 0.71 to 0.83, RMSEA decreased from 0.15 to 0.12, AIC decreased from 563.26 to 307.52, and CAIC decreased from 261.03 to 0.18! Unfortunately, model fit remained below the acceptance criterion detailed above (see Figure Figure 3.2 for tested model and fit statistics).

3.3 Exploratory Factor Analysis on Rumination

I employed exploratory factor analysis to get a better understanding of the actual underlying structure of the rumination measures. Using the psych package in R to test for a two-factor principal components analysis with oblimin rotation, eigenvalues and the resulting scree plot shown in Figure Figure 3.3 support a three-factor solution. Because the second and

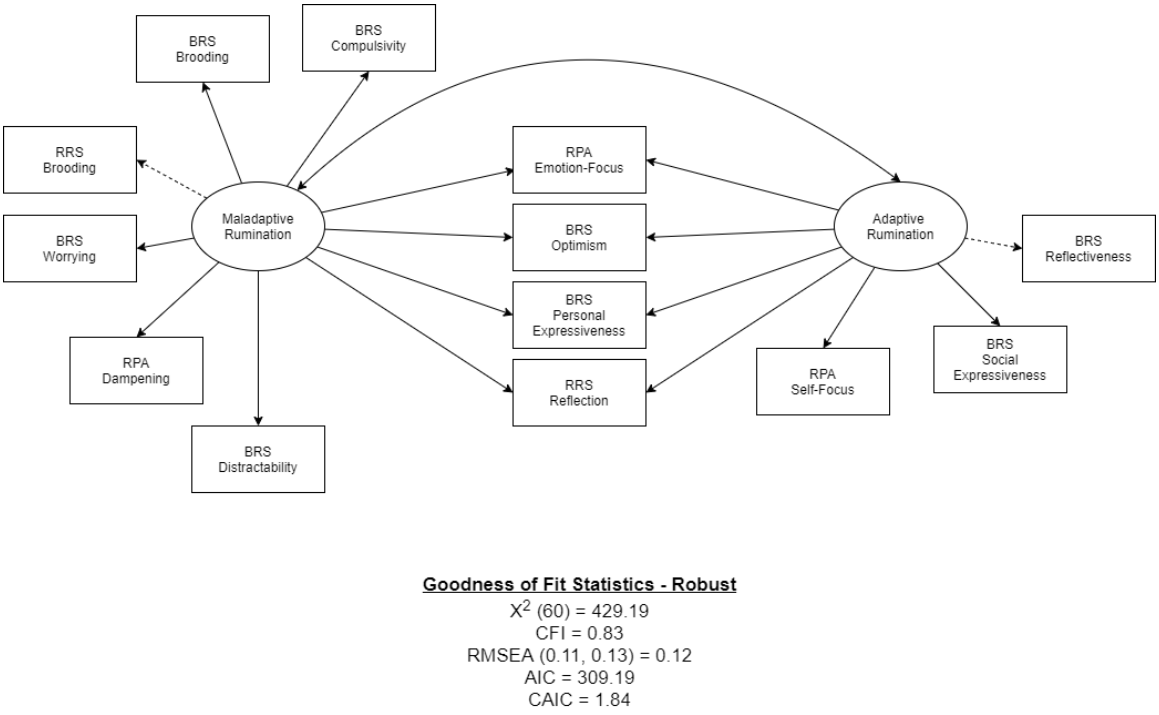


Figure 3.2: Respecified Measurement Model of initially proposed rumination factors

third factors are difficult to interpret and not clearly different from each other in a three-factor solution, a two factor solution was favored. Results from the three-factor solution are shown in Appendix B.

In agreement with my originally proposed rumination structure, there was a clear maladaptive factor composed of eight items; it explained 63% of the relative variance (Factor 1; 32% of the total variance). Additionally, there was a clear adaptive rumination factor composed of six items; it explained 37% of the relative variance (Factor 2; 19% of the total variance). Factor loadings are shown in Table 3.4.

Unlike my proposed measurement model of rumination, only two of the rumination subscales cross-loaded onto both the maladaptive and adaptive factors: BRS-optimism and RRS-Reflection. Instead of cross-loading as hypothesized, however, the BRS-compulsivity and BRS-distractibility subscales best captured maladaptive rumination while the RPA-emotion-focus, BRS-personal-expressiveness, and BRS-social-expressiveness loaded exclusively on adaptive rumination. As predicted, the BRS-brooding, RRS-brooding, BRS-

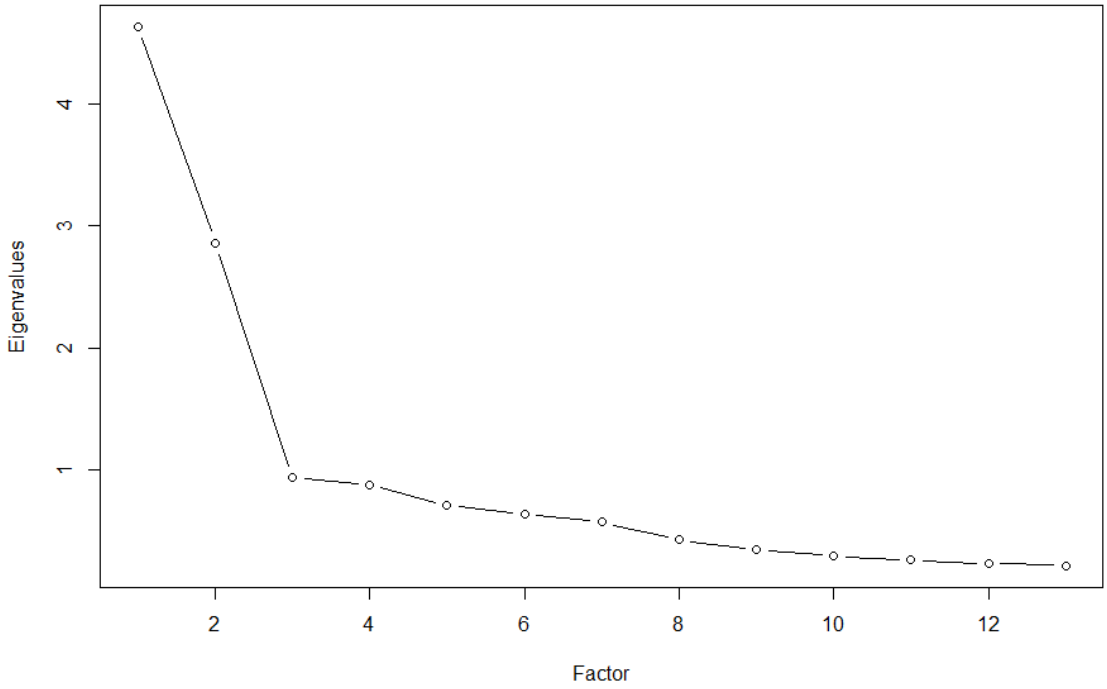


Figure 3.3: Scree plot for two-factor solutions using exploratory factor analysis on the rumination measures

worrying, and RPA-Dampening factors best captured maladaptive rumination while the BRS-reflection, BRS-optimism, and RPA-self-focus loaded exclusively on adaptive rumination.

3.4 Full structural equation model

I first fit a full, non-directional model using all creativity, rumination, and mood variables, setting up the structure of the rumination variables as derived from the exploratory factor analysis reported above. In this non-directional model, dysphoria, adaptive rumination, maladaptive rumination, and creativity were allowed to correlated freely with each other. The results are shown in Figure Figure 3.4. Model fit was acceptable, but neither of the creative ability measures (i.e., the factor for divergent thinking and the single measure of convergent thinking) loaded significantly on the latent creativity factor. To potentially

Table 3.4 EFA Factor Loadings

Measure	Subscale	Factor 1	Factor 2
BRS	Brooding	0.83	
	Compulsivity	0.81	
	Distractibility	0.71	
	Optimism	-0.53	0.54
	Personal Exp.		0.51
	Reflectiveness		0.54
	Social Exp.		0.45
	Worrying	0.68	
RPA	Dampening	0.66	
	Emotion-Focus		0.77
	Self-Focus		0.73
RRS	Brooding	0.83	
	Reflection	0.55	0.43

Note. Factor loadings less than 0.30 are not reported.
BRS = Broad Rumination Scale. RRS = Ruminative Responses Scale. RPA = Responses to Positive Affect Scale.

Table 3.4: Factor loadings for two-factor solution using exploratory factor analysis on the rumination measures

remedy this problem, I decided to exclude convergent thinking, measured by the RAT, from the model. There is evidence that the presence of a convergent thinking construct may moderate the relationship between divergent thinking and creativity (Zhu et al., 2019). Considering the potentially complex moderation effect that comes with the inclusion of convergent thinking, I decided to exclude the RAT from future models. There is a precedent for excluding convergent thinking in favor of divergent thinking in creativity research (Lee et al., 2014; Richardson, 1986).

Removing the RAT, I retested the model. The following paths were not statistically

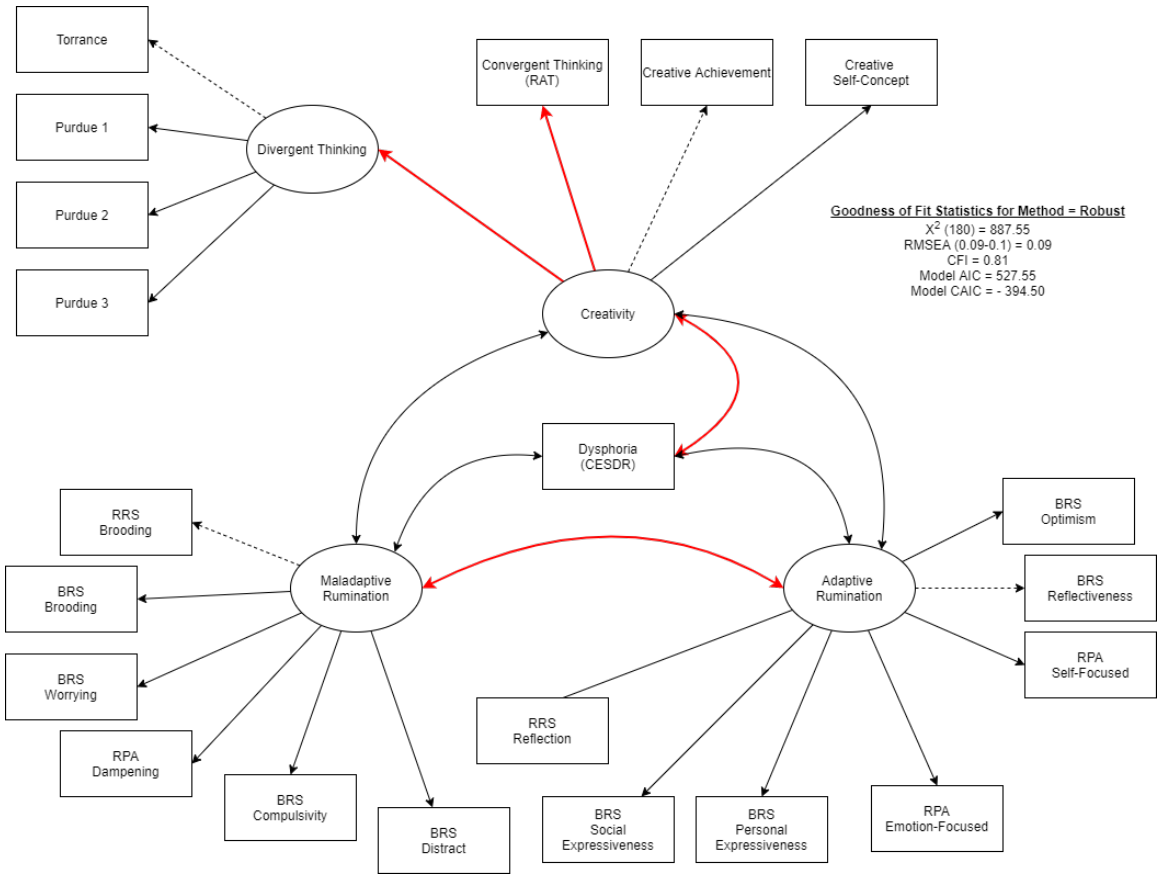


Figure 3.4: Non-directional model in literature with EFA-based measurement model

significant and the model was re-tested with these paths removed: the correlation between creativity and maladaptive rumination, the correlation between maladaptive rumination and adaptive rumination, and the correlation between creativity and dysphoria. Because model fit statistics remained poor based on the fit criterion established above and further changes did not make sense from a theoretical perspective, path weights are not reported and this model structure was rejected.

I then tested a directional model structure with the EFA-based rumination measurement model shown in Figure Figure 3.6. In this model, the adaptive and maladaptive rumination factors were allowed to correlate. Both creativity and dysphoria were endogenous variables predicted by maladaptive and adaptive rumination.

The following paths were not statistically significant and the model was re-tested with these paths removed: the correlation between creativity and maladaptive rumination and

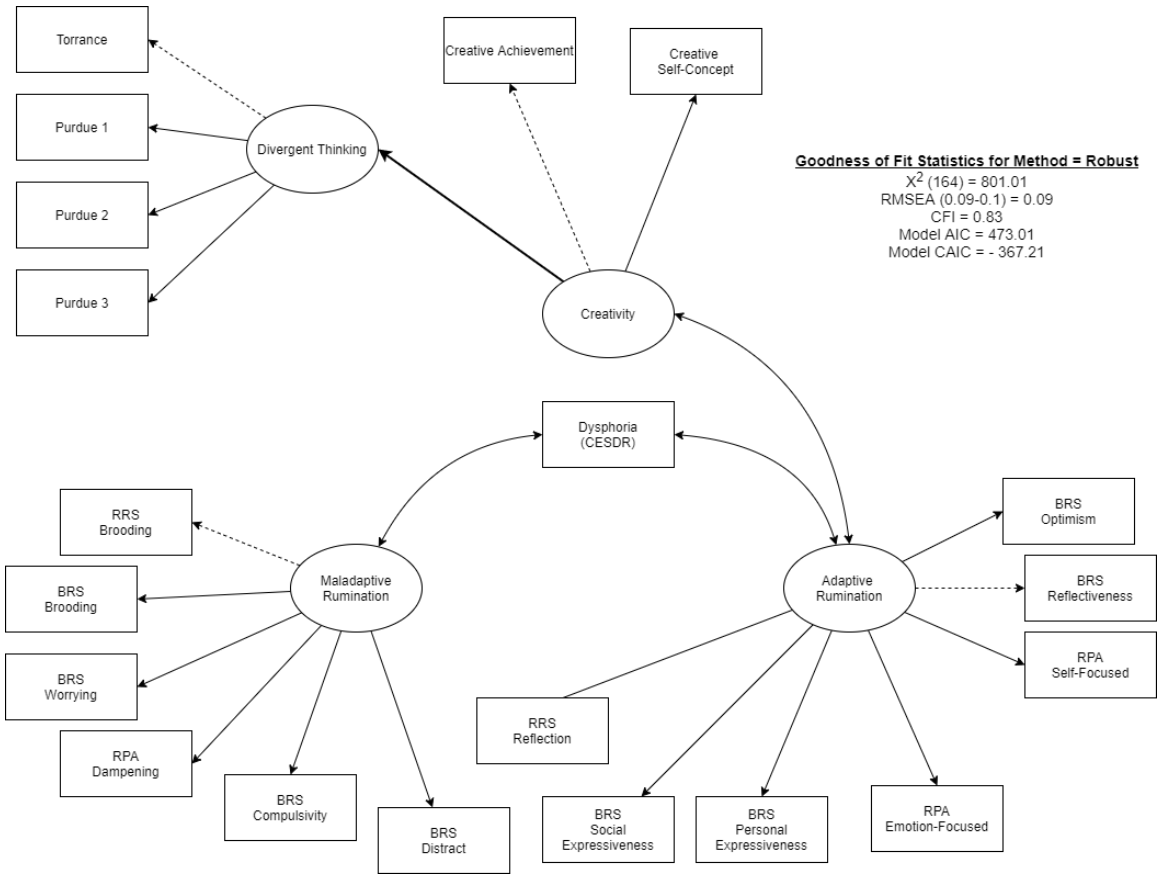


Figure 3.5: Full, directional model including all variables with EFA-based measurement model of rumination

the correlation between maladaptive rumination and adaptive rumination. Results from this simplified model are reported in Figure Figure 3.7. Because model fit statistics remained beneath the acceptable threshold for model fit detailed earlier and further changes did not make sense from a theoretical perspective, path weights are not reported and this model structure was also rejected.

3.5 Simplifying the Rumination Construct

Because the models above failed to yield satisfactory fit, I decided to simplify the rumination construct by selecting a single best measure of rumination. Combining theory with the findings from the EFA, I created unit-weighted z-composites of the maladaptive and adaptive subscales for each measure of rumination. Subscales expected to cross-load based

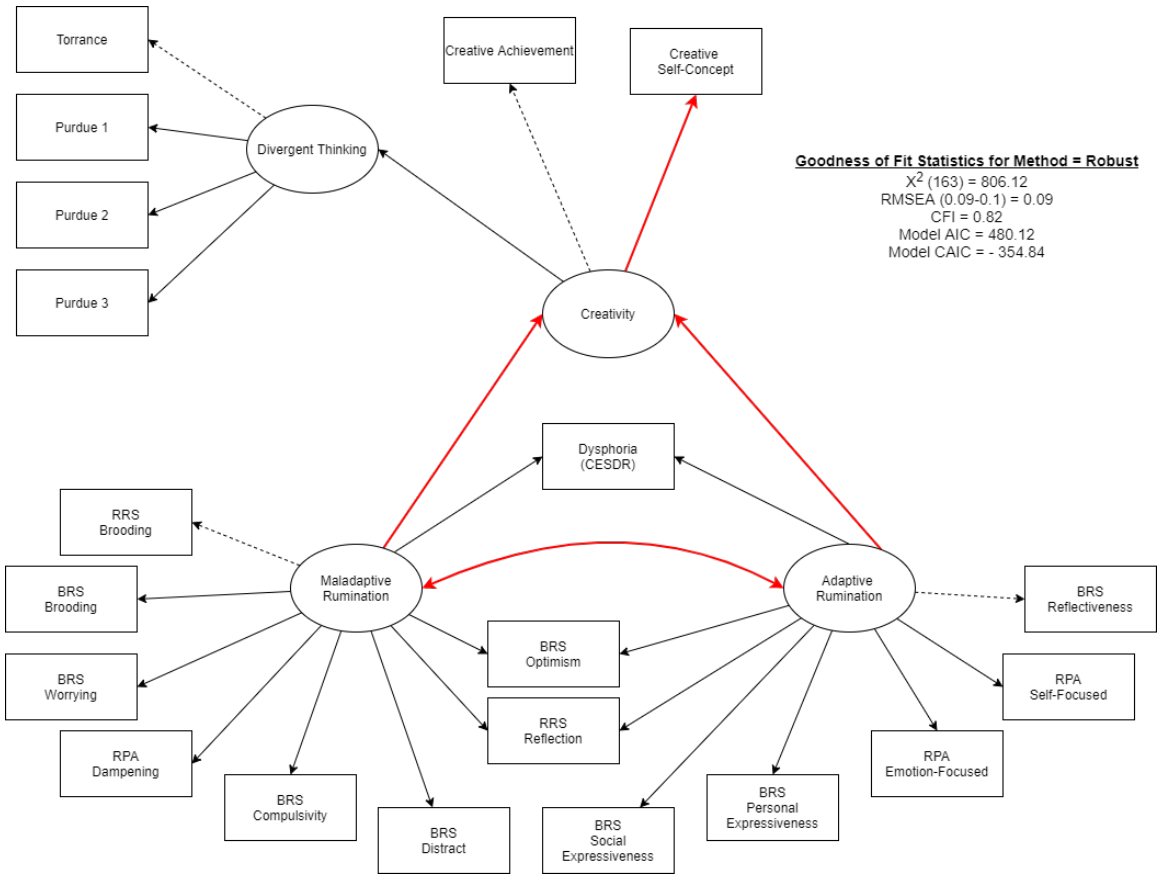


Figure 3.6: Full model on all variables excluding the RAT with EFA-based measurement model of rumination

on theory were not included in the calculation of the composite. For the RRS, maladaptive rumination was defined as a person's z-score on the brooding subscale while adaptive rumination was defined as a person's z-score on the reflection subscale. For the RPA, maladaptive rumination was defined as a person's z-score on the dampening subscale. Based on the EFA results for the RPA scale, the adaptive rumination factor was defined as the unit-weighted composite of a person's z-scores on both the emotion-focus and self-focus subscales. For the BRS, maladaptive rumination was defined as the unit-weighted composite of a person's z-scores on both the worrying and brooding subscale. For the BRS, adaptive rumination was defined as the unit-weighted composite of a person's z-scores on both the optimism and reflectiveness subscales.

Correlations between the maladaptive and adaptive rumination factor for each rumina-

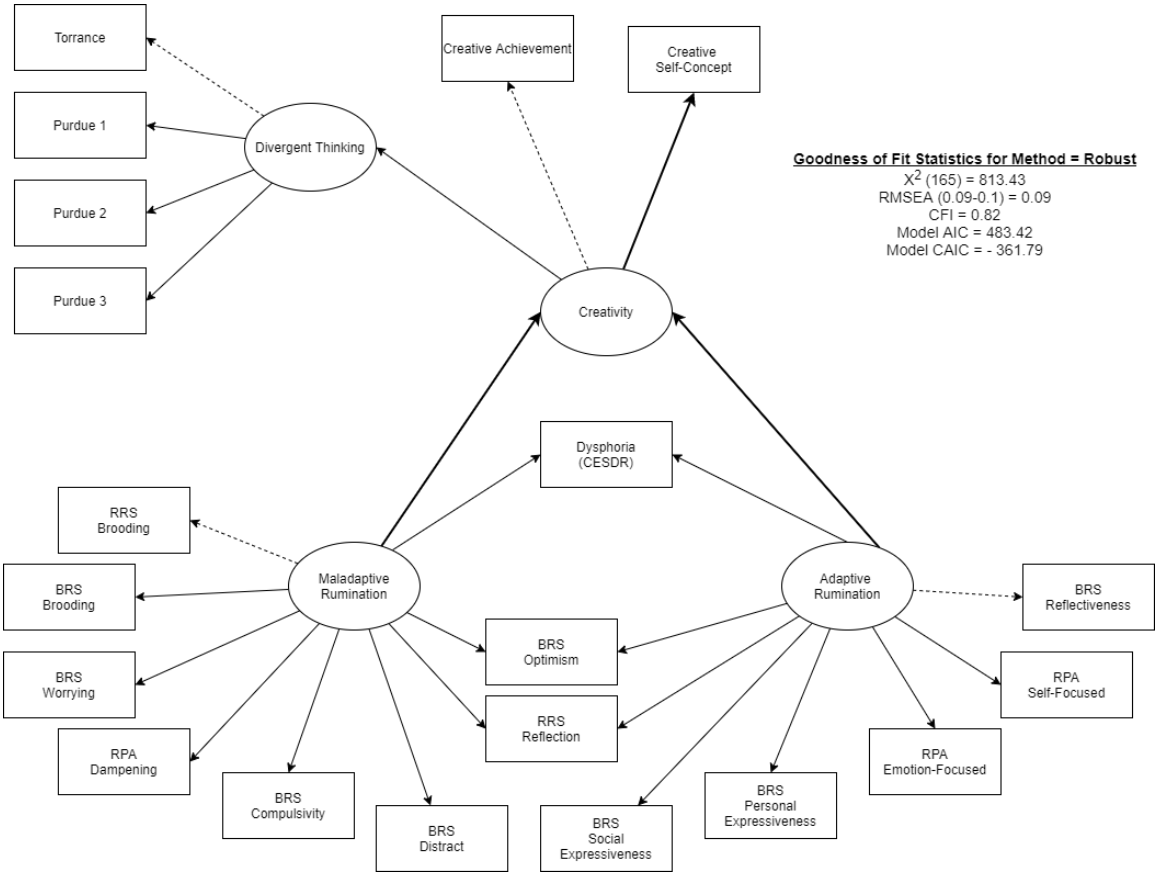


Figure 3.7: Directional model on all variables excluding the RAT with EFA-based measurement model of rumination

tion scale are reported in Table 3.5. Further supporting my assertion that the RRS is actually a measure of maladaptive ruminative tendencies, the RRS adaptive scale (i.e., RRS-reflection) is the only scale of assumed adaptive rumination that positively correlates with other measures of maladaptive rumination. Because the adaptive nature of the RRS subscales remain unclear and because the subscale does not appear to add clarity to the present analyses, the RRS will be dropped from the final SEM model.

When comparing the correlations, the BRS maladaptive scales showed the highest positive correlations with other maladaptive scales and the highest negative correlations with adaptive scales of rumination (except for the adaptive subscale of the RRS, in which case the correlation was positive). The adaptive scale of the BRS not only correlated positively with adaptive scales but also correlated negatively with maladaptive scales of other mea-

Table 3.5. Correlations between unit-weighted composites for the adaptive and maladaptive factors of each rumination scale

	1	2	3	4	5	6	7
1. CESDR	~						
2. RRS_adaptive	0.38**	~					
3. RRS_maladaptive	0.55**	0.55**	~				
4. RPA adaptive	-0.19**	0.21**	0.05	~			
5. RPA_maladaptive	0.56**	0.34**	0.59**	-0.16**	~		
6. BRS_adaptive	-0.33**	0.24**	-0.15**	0.52**	-0.23**	~	
7. BRS_maladaptive	0.53**	0.35**	0.66**	-0.16**	0.62**	-0.24**	~

*Note. RRS = Ruminative Responses Scale. RPA = Responses to Positive Affect Scale. BRS = Broad Rumination Scale. Dysphoria = CESDR. * = significant at the p < 0.05 level. ** = significant at the p > 0.01 level*

Table 3.5: Correlations between maladaptive and adaptive rumination factors for each rumination scale

sures. The adaptive scale of the RPA correlated positively with all adaptive scales but failed to significantly correlate with the RRS maladaptive scale making the full nature of the RPA adaptive scale difficult to interpret. Moreover, the BRS-reflectiveness factor is the only rumination subscale that does not correlate significantly with my measure of dysphoria suggesting that the BRS-reflectiveness may represent a pure measure of adaptive rumination. For these reasons, the BRS emerged as the best scale to represent rumination in the final SEM model.

3.5.1 BRS Measurement Model

I tested the measurement model for the BRS using the structure suggested by the EFA. Originally, I had allowed maladaptive and adaptive rumination to correlate, but this path was removed as it was not statistically significant. The accepted measurement model along with path weights and model fit is shown in Figure Figure 3.8. To elaborate, CFI fell in the ideal model fit range with value greater than 0.95. RMSEA also met acceptable model threshold at 0.06 with a confidence interval ranging between 0.04 and 0.08 indicating that the population RMSEA value is likely also within my established acceptance criterion.

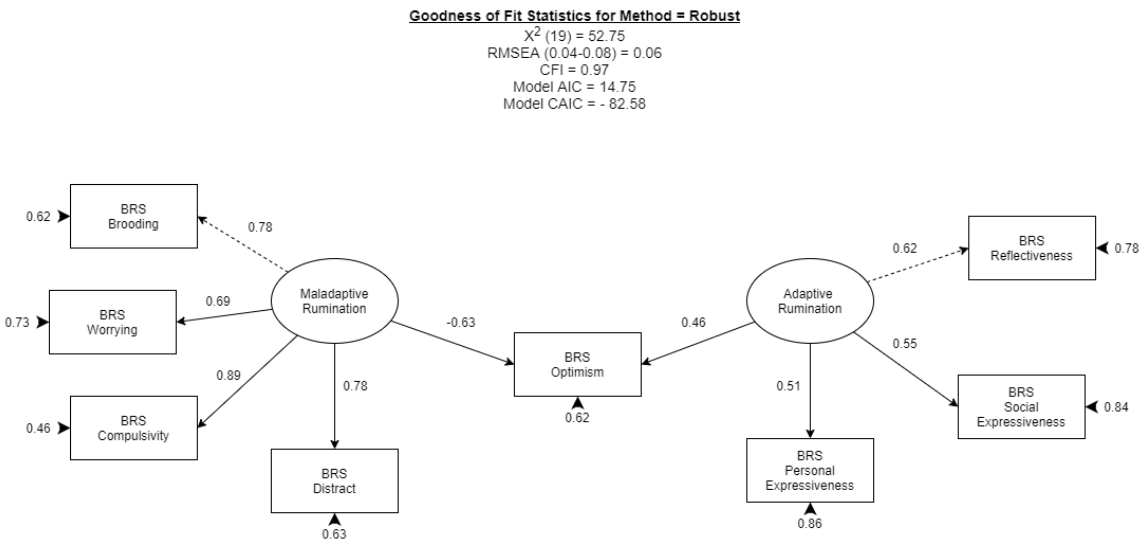


Figure 3.8: First test of the proposed model with rumination defined as the BRS

3.6 SEM on Non-directional Full Model with Simplified Rumination Construct

Using the BRS measurement model structure shown in Figure Figure 3.8, I tested my hypothesized model using a full SEM on all proposed factors. In this model, creativity and dysphoria were allowed to correlate with each other as well as with the adaptive and maladaptive rumination factors. In the first test of the model, neither the path from the creativity factor to the RAT nor the correlation between creativity and dysphoria were statistically significant; these paths were removed, and the model was retested.

In the second test of the model, the correlation between dysphoria and adaptive rumination was not statistically significant; this path was removed and the model was retested. Model fit improved: chi square Model fit and path weights for the third model can be seen in Figure Figure 3.9.

3.7 SEM on Proposed Full Model with Simplified Rumination Construct

Using the BRS measurement model structure shown in Figure Figure 3.8, I tested my hypotheses using a full SEM on all proposed factors. The path from adaptive rumination to dysphoria was not statistically significant. The revised model was retested and results are

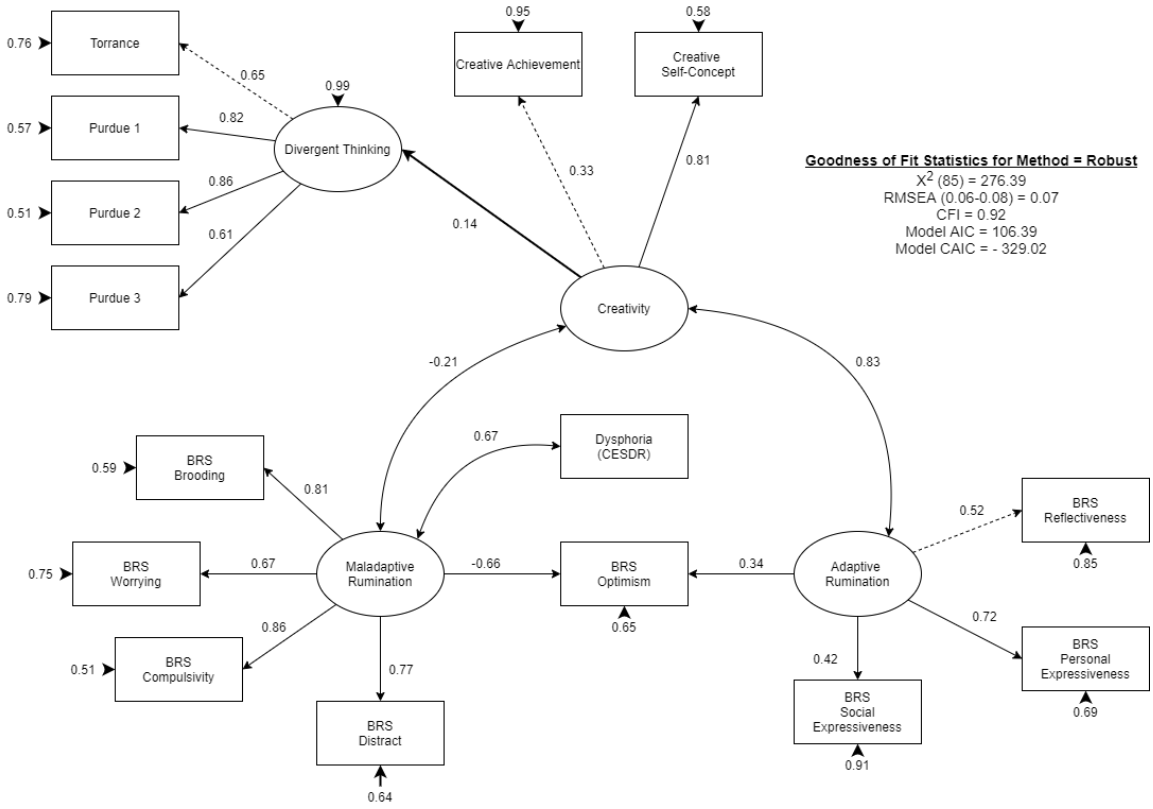


Figure 3.9: Final statistics for the non-directional model with simplified rumination construct

shown in Figure Figure 3.10. Model fit was adequate (albeit, less than ideal) and paths supported my hypotheses. Comparatively, however, the non-directional model shown in Figure Figure 3.9 maintained better model fit. Thus, the directional model is rejected in favor of the non-directional model.

In a last effort to find a place for convergent thinking, I added a causal path from adaptive rumination (independent variable) to the RAT. Not only was the causal path from adaptive rumination to the RAT not statistically significant, but also model fit worsened; thus, the model was rejected ($\chi^2(99) = 395.28$; RMSEA(0.07-0.09) = 0.08; CFI = 0.90; AIC = 197.28; CAIC = -309.85) and further attempts to include the RAT will not be attempted. To conclude, the model shown in Figure Figure 3.9 is accepted as the final model.

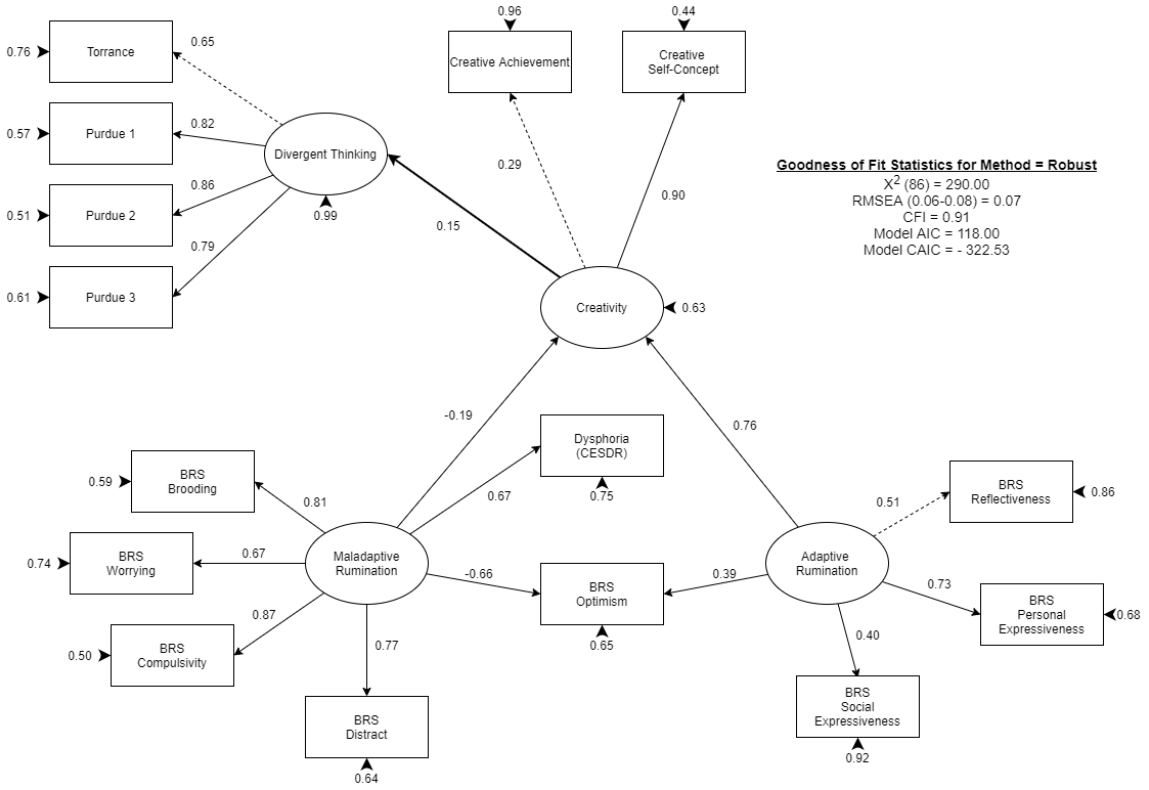


Figure 3.10: Final statistics for the directional model with simplified rumination construct

3.8 Replicating Model Structure

The model fit for the final model, although adequate, remains less than ideal. Additionally, the BRS is a novel measure of rumination. Thus, replicating model structure using a more widely accepted measure of rumination is desirable. Fortunately, the RRS is one of the most accepted and widely used measures of rumination with over 3400 citations[1]! Although the RRS has limitations, as noted earlier in this paper, a replication of the general model structure – that is, the paths between rumination, creativity, and dysphoria – using the RRS as the sole metric of rumination would give more credence to the model structure shown in Figure Figure 3.9

I tested the non-directional model structure using the RRS brooding subscale as the indicator for maladaptive rumination and the RRS reflection subscale as the indicator for

[1] According to Google Scholar, retrieved on 4/23/2021

adaptive rumination in Figure Figure 3.11. In this model, creativity and dysphoria were allowed to correlate freely both with each other and with the maladaptive and adaptive rumination factors. Additionally, because the RRS subscales are so highly correlated with each other, a correlation between them was estimated as well. In the first test of this model, the correlation between creativity and the RRS brooding subscale was not statistically significant, nor was the correlation between creativity and dysphoria. The model was tested a second time with statistically non-significant paths set to zero; this final non-directional model is represented in Figure Figure 3.11.

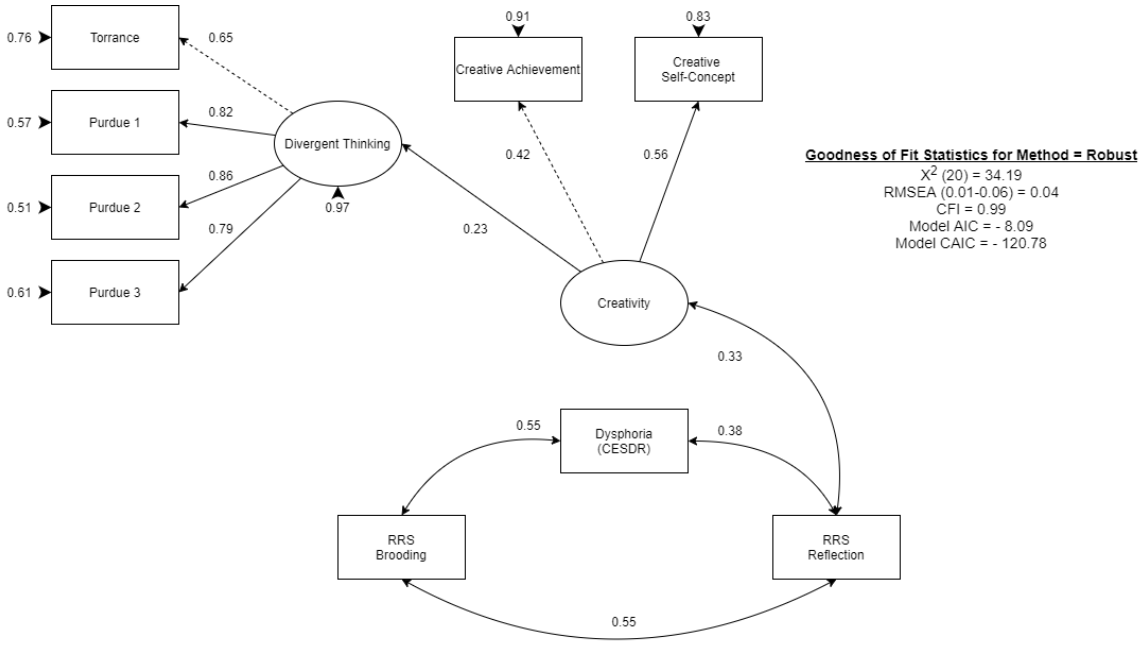


Figure 3.11: Final non-directional model with RRS as the sole measure of rumination

I tested the directional model structure using the RRS brooding subscale as the indicator for maladaptive rumination and the RRS reflective subscale as the indicator for adaptive rumination in Figure Figure 3.12. Model fit was excellent and the general model structure confirmed the directional model structure in Figure Figure 3.10. Model fit was slightly better for the non-directional model than the directional model.

I discuss the overall implications of these findings in the next section.

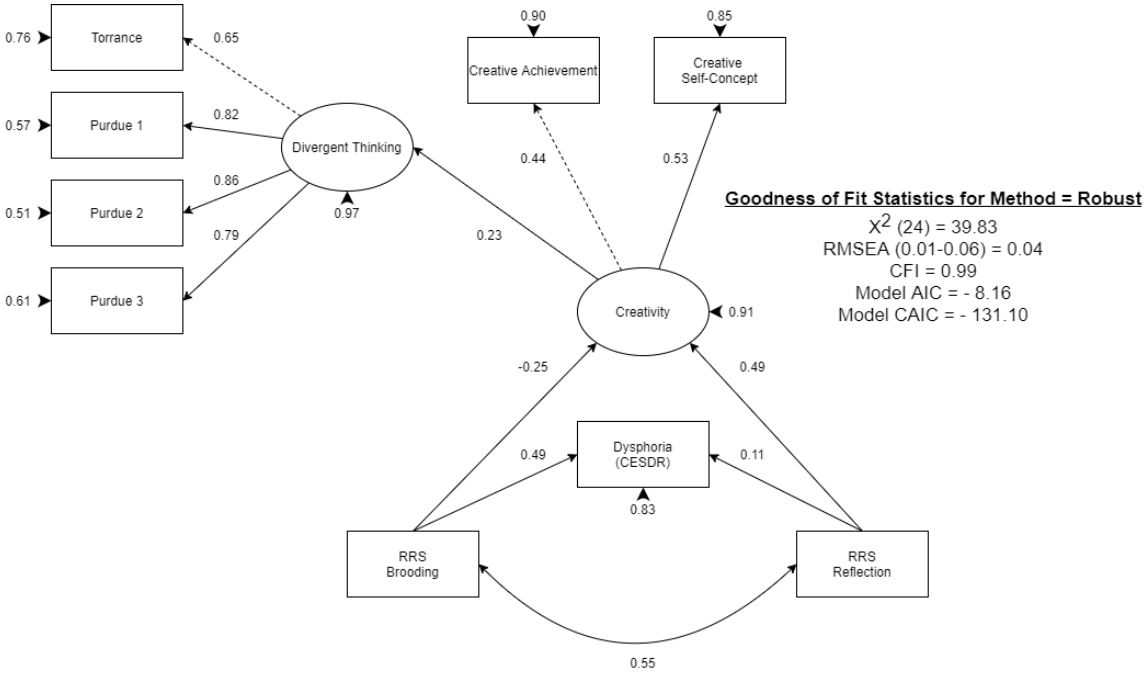


Figure 3.12: Final directional model with RRS as the sole measure of rumination

CHAPTER 4
DISCUSSION

My dissertation utilized structural equation modeling to test the relationship between dysphoria, creativity, and rumination. Specifically, I wanted to better understand the impact of both adaptive and maladaptive rumination on creativity and dysphoria. I predicted that greater tendencies to engage in adaptive rumination would result in greater creativity and lower dysphoria. In contrast, as the tendency to engage in maladaptive rumination increases, a person's creativity would suffer as would their psychological resiliency – that is, increases in maladaptive rumination would be accompanied by increases in dysphoria. In addition to these hypotheses, I tested two model structures of the underlying relationships between these constructs. First, a non-directional model in which creativity and dysphoria were allowed to freely correlate with both the adaptive and maladaptive rumination factors. Second, a directional model in which creativity and dysphoria were jointly caused by (i.e., endogenous variables of) adaptive and maladaptive rumination. I hypothesized that, regardless of directionality, the relationship between creativity and adaptive rumination would be both statistically significant and positive whereas the relationship between creativity and maladaptive rumination would be negative. I also hypothesized that, regardless of directionality, the relationship between dysphoria and maladaptive rumination would be both statistically significant and positive whereas the relationship between dysphoria and adaptive rumination would either be negative or not statistically significant. Findings supported my hypotheses and favored a non-directional model.

4.1 The relationship between creativity and dysphoria

As discussed in the Introduction, a pervasive view in artist communities and among some creativity researchers is the "mad-genius" hypothesis which posits that there is a direct and

potentially beneficial relationship between creativity and dysphoria (see Becker, 2014, for a review). A goal for the present research was to evaluate the relationship between creativity and dysphoria – specifically, to determine if creativity and dysphoria are directly linked or if the relationship between these constructs could be better explained by the presence of a third-variable, rumination. None of the models or Legrange multiplier tests for adding paths supported either a direct or a correlational relationship between creativity and dysphoria when both adaptive and maladaptive rumination factors are present. This finding adds support to the growing argument that creativity and dysphoria are related only through the actions of third variables, like rumination (Verhaeghen et al., 2005; Verhaeghen et al., 2017).

4.2 Measuring rumination

Generally speaking, the majority of studies investigating rumination tend to rely on the Ruminative Responses Scale (**RRS**; Nolen-Hoeksema & Morrow, 1991, with a reflection and a brooding subscale) as the sole indicator of a person's tendency to ruminate. The present research sought to extend the number of indicators of rumination by including subscales from two other rumination scales: the Broad Rumination Scale (**BRS**; Trani & Verhaeghen, forthcoming) and the Responses to Positive Affect questionnaire (**RPA**; Feldman et al., 2008). Additionally, I argued that the subscales of these rumination measures could be categorized as a form of adaptive and/or maladaptive rumination. My proposed measurement model of rumination was not supported and the suggestions for added paths via the Legrange Multiplier test could not be justified using established theory.

Because I did not have additional apriori predictions about the structure of rumination, I turned to exploratory factor analysis for further guidance. My hypothesis that rumination could be categorized as either adaptive or maladaptive in nature was supported by the finding of a two-factor solution with correlated factors that could be arguably interpreted as adaptative and maladaptive rumination. Furthermore, only two subscales - the

BRS optimism and RRS reflection subscales – could be categorized as both adaptive and maladaptive in nature (i.e., these subscales crossloaded onto both factors).

Considering the design of the RRS, it is not surprising that the reflection subscale would not be measuring purely adaptive rumination. Specifically, the intercorrelation between the RRS brooding and reflection subscales was quite high (r = .53) for subscales thought to measure different aspects of rumination. Additionally, items on the RRS have been shown to be relatively confounded with symptoms of dysphoria (Treynor et al., 2003); indeed, both subscales maintained moderate, positive correlations with dysphoria in the present study and the RRS reflection subscale crossloaded on both the maladaptive and adaptive factors in both the two- and three-factor EFA documented here.

That the BRS optimism subscale represents aspects of both adaptive and maladaptive rumination (but with loadings of opposite sign) is intriguing. It is possible that the BRS optimism subscale reflects an adaptive tendency toward psychological resilience – that is, a person's natural ability to cognitively return to a baseline set point after experiencing difficulties or setbacks. It is also possible that the underlying nature of ruminative optimism and psychological resiliency is, to some degree, the opposite of maladaptive rumination. In this way, the BRS optimism scale may be acting as a sort of reverse-indicator for behaviors that represent maladaptive rumination. To illustrate, a person with a high score in the BRS optimism scale is likely to think positively about themselves whereas a person with a greater tendency toward maladaptive rumination is more likely to think negatively about themselves. Future research is necessary to better understand this relationship as well as to improve our definitions of maladaptive rumination within the context of psychological resiliency.

4.2.1 Combining Rumination Measures

Perhaps one of the most intriguing and frustrating aspects of the present research was the lack of cohesiveness between rumination measures when used together to model relation-

ships with the other constructs of interest (i.e., creativity and dysphoria). I had assumed that using multiple indices of rumination would improve my ability to model the relationship between creativity, rumination, and dysphoria. In contrast, model fit was dramatically reduced with the addition of multiple indicators of rumination to the model.

As discussed earlier, items on the RRS are known to be confounded with symptoms of dysphoria (Treynor et al., 2003). Thus, including this measure may make it more mathematically difficult to identify variance specific to a rumination factor separate from dysphoric variance. The RPA scales were likewise difficult to interpret. Specifically, the RPA adaptivity factor does not correlate with the RRS maladaptive rumination factor, arguably the standard metric of maladaptive rumination.

Because the literature so far has failed to clearly divide measures of rumination into two, pure, adaptive/maladaptive factors, trying to assign adaptivity at the level of measurement subscales may currently not be possible. Until measures of rumination are better understood from this two-factor approach, it is likely necessary to evaluate item adaptiveness rather than subscale adaptiveness. Examining the structure of rumination across measures at the item level may allow researchers to forego the difficulties encountered in the present dissertation and successfully combine measures of rumination within greater predictive models. It is worth noting, however, that the BRS subscales fell more naturally into the two-factor structure, and might therefore be good candidate measures for researchers interested in investigating relatively pure measures of adaptive and maladaptive rumination.

4.3 Rumination and Depression

Regardless of measure, the non-directional models indicated that the relationship between dysphoria and maladaptive rumination is both statistically significant and positive. The relationship between adaptive rumination and dysphoria is not statistically significant in the non-directional model that utilized the BRS as the rumination measure. Because items on the RRS are known to be confounded with symptoms of dysphoria, it is not surprising that

the RRS adaptiveness subscale is also correlated with dysphoria. Even with the confounding effect, however, the correlation between adaptive rumination and dysphoria is seventeen times lower than the correlation between maladaptive rumination and dysphoria. Although the directionality is unclear in the present study, people with a tendency toward maladaptive rumination also have a tendency to feel more dysphoric than people who engage in adaptive rumination.

4.4 Rumination and Creativity

As discussed earlier, I predicted that adaptive rumination would have a positive impact on creativity. Regardless of measure, the path between adaptive rumination and creativity was both significant and positive in the non-directional models whereas the path between maladaptive rumination was either negative or not statistically significant. Although directionality is not clear, it seems fair to conclude that adaptive rumination supports creativity whereas maladaptive rumination impairs creativity.

Moreover, it appears that creativity and dysphoria are linked together solely by the presence of maladaptive rumination – not adaptive rumination. In the non-directional model with the RRS, the maladaptive and adaptive factors are correlated, which may account for the statistically non-significant path between creativity and maladaptive rumination. In contrast, the maladaptive and adaptive rumination factors were not allowed to correlate in the non-directional model with the BRS because of the underlying measurement structure of the BRS. As a result, some of the variance in the BRS maladaptive rumination factor may be related to creativity, however, this relationship is negative suggesting that creativity is reduced in people with a greater tendency toward maladaptive rumination.

4.5 Convergent Thinking

I assumed that convergent thinking as measured by the Remote Associates Test (RAT; Mednick, 1968) would be an important subfactor in the structural model of creativity. Un-

fortunately, including the RAT as a subfactor of creativity made it difficult to interpret the meaning of the latent creativity factor. I argue that convergent thinking is still likely an important factor in the greater understanding, modeling, and prediction of creativity as a latent factor. That being said, it may be that convergent thinking relates to creativity through the action of a creative sub-process, such as the frequency of creative output, rather than sharing a direct relationship with a latent, general creativity factor. Further research is needed to better understand the relationship between convergent thinking and creativity.

4.6 Conclusion

The present study investigated models of rumination, creativity, and dysphoria. Findings support a two-factor adaptive/maladaptive structure of rumination. Further psychometric studies are needed to evaluate the viability of existing measures of rumination within this context. Dysphoria is higher and creativity is lower in people with a tendency toward maladaptive rumination. In contrast, creativity is higher and dysphoria is lower in people with a tendency toward adaptive rumination. Findings support the hypothesis that rumination may completely account for the observed relationship between creativity and dysphoria.

Appendices

APPENDIX A

APPENDIX

A.1 Appendix A

A.1.1 Order of Measures

Measures were provided to participants in the following order:

1. Informed consent
2. Torrance Test of Creative Thinking
3. Purdue Creativity Tests
4. Remote Associates Test (RAT)
5. Creative Achievement Questionnaire (CAQ)
6. Short Scale of Creative Self (SSCS)
7. Broad Rumination Scale (BRS)
8. Responses to Positive Affect (RPA)
9. Ruminative Responses Scale (RRS)
10. Center for Epidemiological Studies Depression Scale Revised (CESDR)
11. Information regarding counseling services for people who may need psychological assistance

Detailed information for each measure is provided in the following sections.

A.1.2 CESDR

Specific instructions for the CESDR as folows, ”Below is a list of the ways that you might have felt or behaved. Please indicate how often you have felt this way in the past WEEK OR SO”. Response options were listed as: ”Not at all or less than one day”, ”1-2 days”, ”3-4 days”, ”5-7 days”, and ”Nearly every day for two weeks”.

Items for the CESDR were presented in the following order:

1. My appetite was poor.
2. I could not shake off the blues.
3. I had trouble keeping my mind on what I was doing.
4. I felt depressed.
5. My sleep was restless.
6. I felt sad.
7. I could not get going.
8. Nothing made me happy.
9. I felt like a bad person.
10. I lost interest in my usual activities.
11. I slept much more than usual.
12. I felt like I was moving too slowly.
13. I felt fidgety.
14. I wished I were dead.
15. I wanted to hurt myself.

16. I was tired all the time.

17. I did not like myself.

18. I lost a lot of weight without trying to.

19. I had a lot of trouble getting to sleep.

20. I could not focus on the important things.

A.1.3 Rumination Measures

Specific instructions for the BRS were as follows, ”Please read each statement and indicate the extent to which it generally applies to you and your thoughts.” Items were fully randomized in presentation.

Specific instructions for the RPA were as follows, ”People think and do many different things when they feel happy. Please read each of the following items and indicate whether you never, sometimes, often, or always think or do each one when you feel happy, excited, or enthused. Please indicate what you generally do, not what you think you should do.” Items were fully randomized in presentation.

Specific instructions for the RRS were as follows, ”People think and do many different things when they feel depressed. Please read each of the items below and indicate whether you almost never, sometimes, often, or almost always think or do each one when you feel down, sad, or depressed. Please indicate what you generally do, not what you think you should do.” Items were fully randomized in presentation.

Readers are directed to Appendix C where detailed item information is reported for each scale.

A.1.4 Torrance Test of Creative Thinking

Participants were first presented with the following instructions, ”This next exercise is timed. You will have three minutes to complete the task. Please try to keep responding

for the entire time. When you are ready to begin, click 'Start Timer!'".

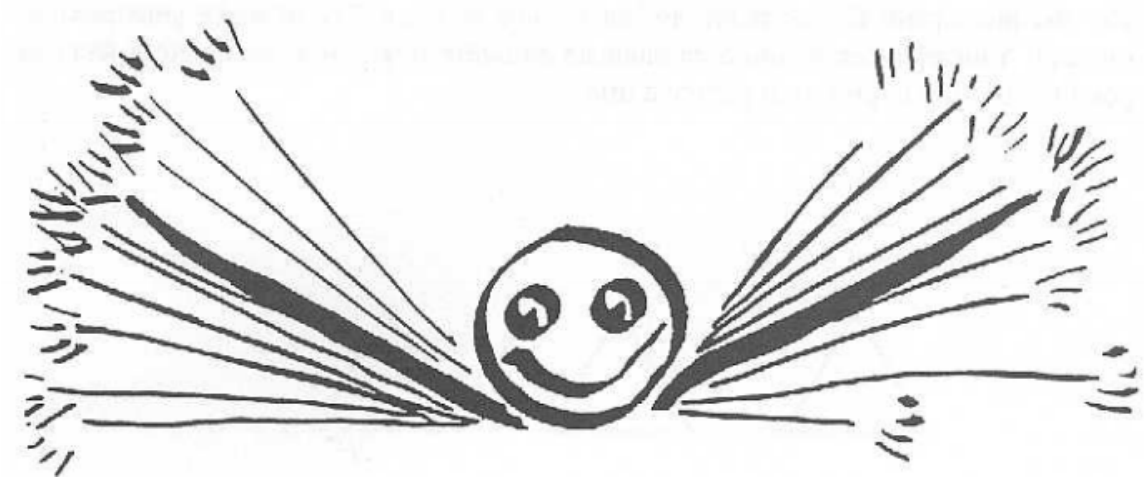
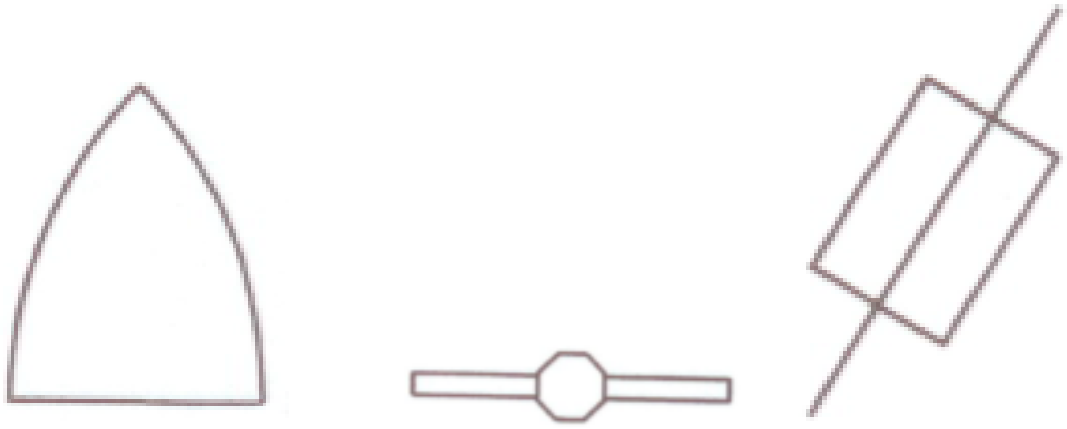


Figure A.1: Image presented to participants taking the Torrance Test of Creative Thinking

Once the timer started, participants were presented with Figure **??** and the following instructions, "Just suppose you could walk on air or fly without being in an airplane or similar vehicle. What problems might this create? Use a period to separate each different answer". Answers were typed into a provided text box. Participants were given three minutes to respond.

A.1.5 Purdue Creativity Test

The Purdue Creativity Test consisted of three parts. Before the beginning of each part, participants were provided with a break screen that contained the following instructions, "This next exercise is timed. You will have two minutes to complete the task. Please try to keep responding for the entire time. When you are ready to begin, click 'Start Timer!'".



(a) Part 1 (b) Part 2 (c) Part 3

Figure A.2: figures displayed for each of the three parts of the Purdue test

Upon starting the timer, participants received Image Figure A.2a, Figure A.2b, or Figure A.2c for the respective part of the Purdue test. Instructions were as follows, ”What is this? List as many possibilities as you can. Write each answer on a new line.” Answers were typed into a provided text box. Participants were given two minutes to respond to each of the three parts.

A.1.6 Creative Achievement Questionnaire

The CAQ is split into three separate parts.

Specific instructions for the first part were as follows, ”Please select the areas in which you feel you have more talent, ability, or training than the average person. Choose as many as apply to you”. Participants could select from the following areas: Visual arts (painting, sculpture), music, dance, individual sports (tennis, golf), team sports, architectural design, entrepreneurial ventures, creative writing, humor, inventions, scientific inquiry, theater and film, and/or culinary arts.

For the second part, participants were asked to select the sentences that described them for each of the following areas: Visual arts (painting, sculpture; Figure Figure **??**), music, dance, architectural design, creative writing, humor, inventions, scientific inquiry, theater

and film, and the culinary arts. Sentences and values for achievements are detailed in the Figure Figure A.3 below. Participants were also asked to list any other creative achievements that were not mentioned in a provided text box.

The third part of the CAQ asked participants to ”select all the sentences below that apply to you.” Sentences were as follows:

1. One of the first things people mention about me when introducing me to others is my creative ability in the above areas.

2. People regularly accuse me of having an ”artistic” temperament.

3. People regularly accuse me of being an ”absent-minded professor” type.

Part 1 and Part 3 were not used in the dissertation analyses.

1. Visual Arts Area

Item Value	Sentence
0	I have no training or recognized talent in this area (Skip to Music).
1	I have taken lessons in this area.
2	People have commented on my talent in this area.
3	I have won a prize or prizes at a juried art show.
4	I have had a showing of my work in a gallery.
5	I have sold a piece of my work.
6	My work has been critiqued in local publications.
7	My work has been critiqued in national publications.

Note. Participants were asked to indicate the number of times work was critiqued in national publications.

2. Music

Item Value	Sentence
0	I have no training or recognized talent in this area (Skip to Dance).
1	I play one or more musical instruments proficiently.
2	I have played with a recognized orchestra or band.
3	I have composed an original piece of music.
4	My musical talent has been critiqued in a local publication.
5	My composition has been recorded.
6	Recordings of my composition have been sold publicly.
7	My compositions have been critiqued in a national publication.

Note. Participants were asked to indicate the number of time compositions were critiqued in national publications.

3. Dance

Item Value	Sentence
0	I have no training or recognized talent in this area (Skip to Architecture).
1	I have danced with a recognized dance company.
2	I have choreographed an original dance number.
3	My choreography has been performed publicly.
4	My dance abilities have been critiqued in a local publication.
5	I have choreographed dance professionally.
6	My choreography has been recognized by a local publication.
7	My choreography has been recognized by a national publication.

Note. Participants were asked to indicate the number of time choreographies were recognized by national publications.

4. Architectural Design

Item Value	Sentence
0	I have no training or recognized talent in this area (Skip to Writing).
1	I have designed an original structure.
2	A structure designed by me has been constructed.
3	I have sold an original architectural design.
4	A structure that I have designed and sold has been built professionally.
5	My architectural design has won an award or awards.
6	My architectural design has been recognized in a local publication.
7	My architectural design has been recognized in a national publication.

Note. Participants were asked to indicate the number of time designs were recognized in national publications.

5. Creative Writing

Item Value	Sentence
0	I have no training or recognized talent in this area (Skip to Humor).
1	I have written an original short work (poem or short story).
2	My work has won an award or prize.
3	I have written an original long work (epic, novel, or play).
4	I have sold my work to a publisher.
5	My work has been printed and sold publicly.
6	My work has been reviewed in local publications.
7	My work has been reviewed in national publications.

Note. Participants were asked to indicate the number of time works were reviewed in national publications.

6. Humor

Item Value	Sentence
0	I have no training or recognized talent in this area (Skip to Inventions).
1	People have often commented on my original sense of humor.
2	I have created jokes that are now regularly repeated by others.
3	I have written jokes for other people.
4	I have written a joke or cartoon that has been published.
5	I have worked as a professional comedian.
6	I have worked as a professional comedy writer.
7	My humor has been recognized in a national publication.

7. Inventions

Item Value	Sentence
0	I do not have recognized talent in this area.
1	I regularly find novel uses for household objects.
2	I have sketched out an invention and worked on its design flaws.
3	I have created original software for a computer.
4	I have built a prototype of one of my designed inventions.
5	I have sold one of my inventions to people I know.
6	I have received a patent for one of my inventions.
7	I have sold one of my inventions to a manufacturing firm.

Note. Participants were asked to indicate the number of times inventions were awarded patents and/or sold to manufacturing firms.

8. Scientific Discovery

Item Value	Sentence
0	I have no training or recognized talent in this area (Skip to Theater).
1	I often think about ways that scientific problems could be solved.
2	I have won a prize at a science fair or other local competition.
3	I have received a scholarship based on my work in science or medicine.
4	I have been an author or coauthor of a study published in a scientific journal.
5	I have won a national prize in the field of science or medicine.
6	I have received a grant to pursue my work in science or medicine.
7	My work has been cited by other scientists in national publications.

Note. Participants were asked to indicate the number of national prizes and grants received for their work in science or medicine.

9. Theater and Film

Item Value	Sentence
0	I do not have training or recognized ability in this field.
1	I have performed in theater or film.
2	My acting abilities have been recognized in a local publication.
3	I have directed or produced a theater or film production.
4	I have won an award or prize for acting in theater or film.
5	I have been paid to act in theater or film.
6	I have been paid to direct a theater or film production.
7	My theatrical work has been recognized in a national publication.

Note. Participants were asked to indicate the number of times work was recognized in a national publication.

9. Culinary Arts

Item Value	Sentence
0	I do not have training or expertise in this field.
1	I often experiment with recipes.
2	My recipes have been published in a local cookbook.
3	My recipes have been used in restaurants or other public venues.
4	I have been asked to prepare food for celebrities or dignitaries.
5	My recipes have won a prize or award.
6	I have received a degree in culinary arts.
7	My recipes have been published nationally.

Note. Participants were asked to indicate the number of prizes or awards won for recipes.

Figure A.3: Items and values for each area in part two of the CAQ

A.1.7 Remote Associates Test

Before beginning the RAT, participants were presented with the following instructions:

> For this next activity, you will see 30 items consisting of three words each. Your task is to find a word that connects each word set together in a meaningful way. Below, we present you with two examples.
>
> (1) "COTTAGE - SWISS - CAKE" can all be meaningfully connected with the word "CHEESE". (2) "CREAM - SKATE - WATER" can all be meaningfully connected with the word "ICE"
>
> You will have 5 minutes to complete this activity.

Items were presented in the order shown in Table Table A.1. Note that both items and their associated difficulties were obtained from Bowden and Jung-Beeman, 2003. Answers were typed into a provided text field following each item. Participants were given five minutes to respond.

Table A.1: Item order and difficulty information for the Remote Associates Test

ITEM	WORD1	WORD2	WORD3	ASSOCIATE	%SOLVED	DIFFICULTY
1	AID	RUBBER	WAGON	BAND	75	EASY
2	HOME	SEA	BED	SICK	38	MEDIUM
3	HORSE	HUMAN	DRAG	RACE	11	HARD
4	SHADOW	CHART	DROP	EYE	1	HARD
5	ARTIST	HATCH	ROUTE	ESCAPE	5	HARD
6	WORM	SHELF	END	BOOK	53	EASY
7	SELF	ATTORNEY	SPENDING	DEFENSE	4	HARD
8	SHINE	BEAM	STRUCK	MOON	41	MEDIUM
9	CARPET	ALERT	INK	RED	26	HARD
10	CHAMBER	MASK	NATURAL	GAS	33	MEDIUM
11	DUCK	FOLD	DOLLAR	BILL	80	EASY
12	DRESS	DIAL	FLOWER	SUN	29	HARD
13	ROCKING	WHEEL	HIGH	CHAIR	80	EASY
14	LOSER	THROAT	SPOT	SORE	86	EASY
15	PRESERVE	RANGER	TROPICAL	FOREST	76	EASY
16	FRENCH	CAR	SHOE	HORN	34	MEDIUM
17	BREAK	BEAN	CAKE	COFFEE	12	HARD
18	FOUNTAIN	BAKING	POP	SODA	78	EASY
19	LIGHT	BIRTHDAY	STICK	CANDLE	41	MEDIUM
20	SHOW	LIFE	ROW	BOAT	82	EASY
21	DEW	COMB	BEE	HONEY	80	EASY
22	SAGE	PAINT	HAIR	BRUSH	34	MEDIUM
23	MAN	GLUE	STAR	SUPER	18	HARD
24	HAMMER	GEAR	HUNTER	HEAD	25	HARD
25	LINE	FRUIT	DRUNK	PUNCH	9	HARD
26	WATER	MINE	SHAKER	SALT	41	MEDIUM
27	HOUND	PRESSURE	SHOT	BLOOD	42	MEDIUM
28	NIGHT	WRIST	STOP	WATCH	82	EASY
29	PRINT	BERRY	BIRD	BLUE	49	MEDIUM
30	CADET	CAPSULE	SHIP	SPACE	47	MEDIUM

A.1.8 Short Scale of Creative Self

Participants received the following instructions, ”Below you will find several sentences used by people to describe themselves. Please decide to what extent each of these statements describes you. There are no good or wrong answers.” Participants responded by clicking the radial button next to the option that best described themselves. Response options were as follows: ”Definitely not”, ”Somewhat not”, ”Neither yes nor no”, ”Somewhat

yes", "Definitely yes".

Items were presented in the following order:

1. I think I am a creative person.
2. My creativity is important for who I am.
3. I know I can efficiently solve even complicated problems.
4. I trust my creative abilities.
5. My imagination and ingenuity distinguishes me from my friends.
6. Many times I have proved that I can cope with difficult situations.
7. Being a creative person is important to me.
8. I am sure I can deal with problems requiring creative thinking.
9. I am good at proposing original solutions to problems.
10. Creativity is an important part of myself.
11. Ingenuity is a characteristic that is important to me.

A.2 Appendix B

Table of factor loadings for a three-factor solution obtained using exploratory factor analysis with an oblimin rotation in R.

Table A.2: Factor loadings for three-factor solution using exploratory factor analysis on the rumination measures

Measure	Subscale	Factor 1	Factor 2	Factor 3
BRS	Brooding	0.84		
	Compulsivity	0.82		
	Distractibility	0.72		
	Optimism	-0.55	0.42	
	Personal Exp.		0.31	
	Reflectiveness			0.94
	Social Exp.			
	Worrying	0.66		
RPA	RPA Dampening	0.68		
	RPA Emotion-Focus		0.79	
	RPA Self-Focus		0.92	
RRS	RRS Brooding	0.84		
	RRS Reflection	0.44		0.41

Note. Factor loadings less than 0.30 are not reported.
BRS = Broad Rumination Scale. RRS = Ruminative Responses Scale. RPA = Responses to Positive Affect Scale.

In agreement with my originally proposed rumination structure, there was a clear maladaptive factor composed of eight items; it explained 54% of the relative variance (Factor 1; 31% of the total variance). Factor 2 is difficult to interpret but may be thought of as an optimism or positivity factor consisting of 4 items; it explained 27% of the relative variance (Factor 1; 15% of the total variance). Factor 3 is difficult to interpret but may be thought of as a reflection factor consisting of 2 items (both of the BRS and RRS reflection measures); it explained 19% of the relative variance (Factor 3; 11% of the total variance). It is not clear

that Factors 2 and 3 are conceptually different; that is, they both appear to be indicators of adaptive rumination. Factors 1 and 2 were correlated at r = -0.19. Factors 1 and 3 were correlated at r = 0.13. Factors 2 and 3 were correlated at r = 0.36.

A.3 Appendix C

Confirmatory Factor Analyses at the item level for each subscale tested the structure of each scale as proposed by the original authors in the literature. Results are reported below.

I first tested the proposed factor structure of the Broad Rumination Scale (BRS) allowing all factors to correlate in a robust confirmatory factor analysis run in EQS version 6.4 on Windows 10. Model fit was adequate (χ^2(499) = 1339.17; RMSEA (0.06-0.07) = 0.06; CFI=0.87; AIC=341.17; CAIC=-2214.95) and the relationship between all items and their proposed factors were statistically significant. Some of the correlations between factors (i.e., subscales) were not significant, however, and were set to zero. The model was retested and final model fit was acceptable and slightly improved (χ^2(510) = 1358.27 ; RMSEA (0.06) = 0.06; CFI=0.87; AIC=338.272; CAIC=-2274.20). The item factor loadings are reported in Table Table A.3. The correlations between factors are reported in the correlation matrix shown in Table Table A.4.

Table A.3: Item-subscale loadings obtained from the confirmatory factor analysis run on the Broad Rumination Scale (BRS)

Scale	Question	Subscale	Loading	Error	R^2
BRS	When considering my past, I think I have had much more negative events than positive events	Brooding	.65	.76	.42
	When something goes wrong, I tend to think of all the things that have recently gone wrong	Brooding	.76	.65	.57
	There are many things about myself that I wish I could change	Brooding	.65	.76	.42
	When things are going right, I find myself wondering when things are going to go wrong	Brooding	.63	.77	.40
	Bad things always seem to happen to me	Brooding	.67	.75	.44
	When I start to worry, it is very hard for me to stop	Compulsivity	.89	.46	.79
	It is very difficult for me to calm down when I am upset	Compulsivity	.75	.66	.57
	I find it easy to let things go (R)	Compulsivity	.42	.91	.18
	My friends and family have described me as a worrier	Compulsivity	.69	.73	.47
	When something is on my mind, it's hard for me to stop thinking about it	Compulsivity	.74	.67	.55
	I find it very easy to focus on what I am doing, even if I am worried about something (R)	Distractibility	.72	.70	.51
	I can easily control my thoughts (R)	Distractibility	.70	.72	.49
	When I am emotional, it is hard for me to focus on what I am supposed to be doing	Distractibility	.80	.60	.64
	My thoughts have the tendency to distract me from a task at hand	Distractibility	.82	.58	.67
	I find myself daydreaming when I should be paying attention	Distractibility	.64	.77	.41
	I like myself	Optimism	.81	.59	.65
	When I think about my past, I focus on situations where things have gone right.	Optimism	.62	.79	.38
	I am capable of overcoming life's obstacles	Optimism	.63	.78	.40
	My thoughts about myself are more often positive than negative	Optimism	.83	.56	.69
	I like the way that I think	Optimism	.71	.70	.51
	My creative hobbies are a way for me to communicate how I am feeling	Personal Ex	.87	.49	.76
	Art helps me to understand how I am feeling	Personal Ex	.71	.71	.50
	I use my hobbies as a way of expressing myself	Personal Ex	.73	.68	.53
	It is important for me to understand why I am feeling a certain way	Reflection	.81	.59	.65
	When I feel down, it is important for me to understand why	Reflection	.79	.62	.62
	When I have a problem, I take time thinking about it	Reflection	.48	.88	.23
	I like to analyze my thoughts	Reflection	.58	.82	.33
	I tend to vent to my friends when I am feeling overwhelmed	Social Ex	.70	.72	.49
	It helps me to talk about my problems with other people	Social Ex	.78	.63	.60
	I don't want anyone else to know about my problems (R)	Social Ex	.66	.75	.44
	I don't like sharing my thoughts and feelings with others (R)	Social Ex	.71	.71	.50
	Last minute changes in plans are frustrating for me	Worrying	.40	.92	.16
	I find myself thinking, "What if..."	Worrying	.60	.80	.36
	Uncertainty about the future bothers me.	Worrying	.66	.75	.44

Table A.4: Subscale correlations obtained from the confirmatory factor analysis run on the Broad Rumination Scale (BRS)

Table C2: Confirmatory factor analysis subscale correlations for the BRS

	1	2	3	4	5	6	7	8
1. Brooding	~							
2. Compulsivity	.85	~						
3. Distractibility	.70	.86	~					
4. Optimism	-.70	-.64	-.58	~				
Personal								
5. Expressiveness	.00	.00	.00	.22	~			
6. Reflection	.00	.00	.00	.30	.34	~		
Social								
7. Expressiveness	-.10	.00	.00	.32	.29	.45	~	
8. Worry	.93	.89	.76	-.55	.00	.00	.00	~

Note. All reported correlations were significant at $p < 0.05$ in the CFA. Correlations that were not statistically significant were set to 0.

Next, I tested the proposed factor structure for the Ruminative Responses Scale (RRS) using robust confirmatory factor analysis run on EQS version 6.4 on Windows 10. Model fit was adequate ($\chi^2(34) = 140.98$; RMSEA (0.07, 0.10) = 0.08; CFI=0.93; AIC=72.98; CAIC=-101.19) and the relationship between all items and their proposed subscales were statistically significant. The item-subscales loadings are reported in Table A.5. The correlation between the brooding and reflection subscales was significant ($r = 0.65$, p ¡ 0.05).

Table A.5: Item-subscale loadings obtained from the confirmatory factor analysis run on the Ruminative Responses Scale (RRS)

Scale	Question	Subscale	Loading	Error	R^2
RRS	Think: What am I doing to deserve this?	Brooding	.69	.73	.47
	Analyze recent events to try to understand why you are depressed	Reflection	.55	.84	.30
	Think: Why do I always react this way?	Brooding	.76	.65	.58
	Go away by yourself and think about why you feel this way	Reflection	.84	.55	.70
	Write down what you are thinking and analyze it	Reflection	.34	.94	.12
	Think about a recent situation, wishing it had gone better	Brooding	.66	.75	.44
	Think: Why do I have problems other people don't have	Brooding	.76	.65	.58
	Think: Why can't I handle things better?	Brooding	.79	.62	.62
	Analyze your personality to try to understand why you are depresed	Reflection	.61	.79	.38
	Go someplace alone to think about your feelings.	Reflection	.75	.66	.56

Finally, I tested the proposed factor structure for the Responses to Positive Affect (RPA) scale using robust confirmatory factor analysis run on EQS version 6.4 on Windows

10. Model fit was adequate ($\chi^2(116) = 264.54$; RMSEA (0.05, 0.06) = 0.05; CFI=0.94; AIC=33.54; CAIC=-561.67) and the relationship between all items and their proposed subscales were statistically significant. The item-subscales loadings are reported in Table A.6.

Table A.6: Item-subscale loadings obtained from the confirmatory factor analysis run on the Responses to Positive Affect Scale (RPA)

Scale	Question	Subscale	Loading	Error	R^2
	Think: My streak of luck is going to end soon	Dampening	.71	.71	.50
	Think: I don't deserve this	Dampening	.69	.73	.47
	Think about things that could go wrong	Dampening	.79	.62	.62
	Think about things that have not gone well for you	Dampening	.70	.72	.48
	Remind yourself these feelings won't last	Dampening	.67	.75	.45
	Think : This is too good to be true	Dampening	.60	.80	.36
	Think about how hard it is to concentrate	Dampening	.54	.84	.30
	Think: People will think I am bragging	Dampening	.49	.87	.24
RPA	Think about how happy you feel	Emotion-Focus	.76	.65	.58
	Think about how strong you feel	Emotion-Focus	.73	.68	.53
	Think about how you feel up to doing everything	Emotion-Focus	.59	.80	.35
	Notice how you feel full of energy	Emotion-Focus	.68	.73	.47
	Savor this moment	Emotion-Focus	.62	.79	.38
	Think: I am achieving everything	Self-Focus	.76	.65	.58
	Think: I am living up to my potential	Self-Focus	.78	.63	.61
	Think: I am getting everything done	Self-Focus	.68	.74	.46
	Think about how proud you are of yourself	Self-Focus	.73	.69	.53

The correlation between the Dampening and Emotion-Focus subscales was significant (r = -0.21, p ¡ 0.05). The correlation between the Dampening and Self-Focus subscales was significant (r = -0..25, p ¡ 0.05). The correlation between the Emotion-Focus and Self-Focus subscales was significant (r = 0.88, p ¡ 0.05).

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